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SCIENCE FICTION AND FACT

APRIL 2004

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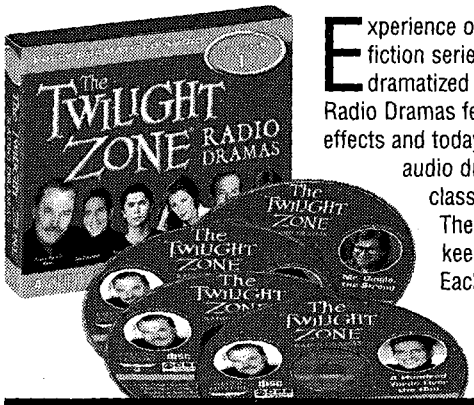

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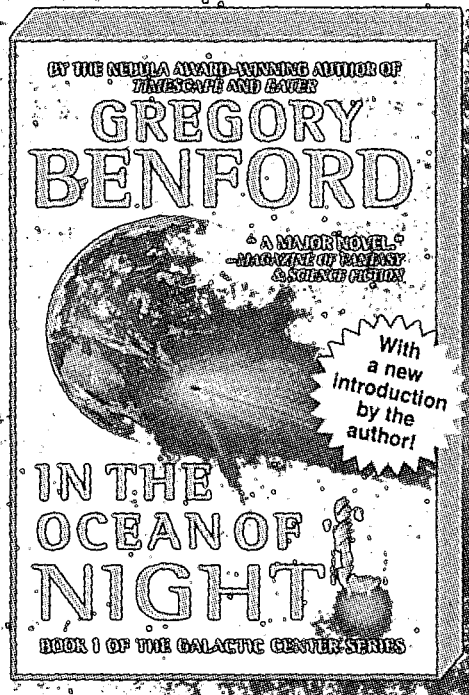
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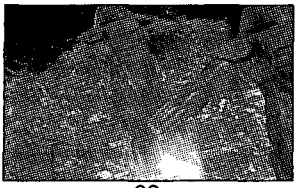

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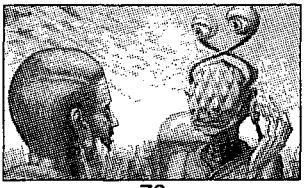

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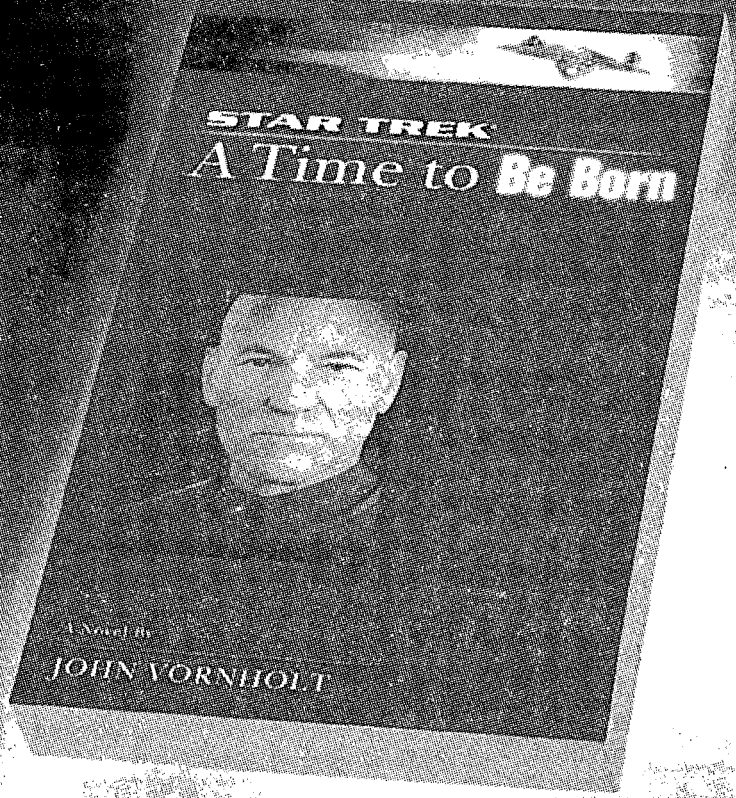

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EDITORIAL Stanley Schmidt

A BILLION BIG BROTHERS

In 1948 Eric Arthur Blair, as "George Orwell," wrote *1984*, a novel describing an Earth kept in a perpetual state of war, and most of its people in a sort of slavery to the state, by a few dictators with technologically enhanced power. Ubiquitous surveillance devices kept people in line and made the slogan "Big Brother Is Watching You" a uniquely charged part of our language. The vast majority of citizens knew only what their government told them about what was going on in the world, and that changed from day to day. Not only current events, but records of past history were continually altered to keep them in line with the government's interests. People's very thoughts were manipulated by means up to and including language itself to insure that they would believe what the government wanted them to, even if it was different from what they were conditioned to believe last week. "Newspeak" evolved from English, but it was a guided evolution, designed to make it impossible to think too deeply about anything, or to think heretical thoughts at all. Individuals' "philosophies" consisted of a handful of official slogans to which they were constantly exposed.

I don't know whether Orwell made any conscious effort to guess what a particular year might be like, or simply pulled the number 1984 out of a figurative hat, reversing the year he lived in to get a vaguely future time, too far off to be seen clearly but close enough to be scary. Either way, when the real 1984 rolled around, publishers and entertainment promoters jumped on a predictable bandwagon, trotting out new screenings of old movies, new editions of an old book, and scholarly and not-so-scholarly discussions of how Ol' George did in the prediction department.

I think the general reactions of people rereading *1984* or discovering it for the first time were somewhere between relief and amusement. The real 1984 didn't look much like the book at all, and current trends didn't even seem to be headed in that direction. If any classic dystopia seemed even vaguely threatening then, Aldous Huxley's *Brave New World*, with its consumerism run amok, seemed a more likely candidate—though even there the resemblance wasn't very close.

So did we really dodge the bullet—or might Orwell's 1984 be "the year that came late"?

It still doesn't seem likely that we'll get exactly what Orwell envisioned, but many of its attributes are now looking frighteningly plausible—much more so than in the real 1984. We have an assortment of dictators rendered more than annoying by their access to dangerous technologies, and many of them are involved in, or threatening, wars that could spread far beyond their origins. Most people have no way of knowing what's really going on in those wars except what they're told by news media, and little way of knowing to what extent that information is provided or filtered by their governments.

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We have (admittedly in response to a real and frightening threat) new legislation granting our own government sweeping new powers—powers that would have been unthinkable a decade ago—to snoop in its own citizens' lives and to suspend due process for whole categories of people regarded as dangerous. We have huge databases, and proposals for combining them in new ways, to facilitate keeping close tabs on the lives of large numbers of people, citizens and foreigners alike. We have a widespread "sound-bite mentality" and acceptance of short attention spans that bears an uncomfortable resemblance to Newspeak and its slogans. If you think the comparison farfetched, consider this quote from "The Principles of Newspeak," Orwell's own Appendix to *1984*: "In Newspeak, euphony outweighed every consideration other than exactitude of meaning. Regularity of grammar was always sacrificed to it when it seemed necessary. And rightly so, since what was required, above all for political purposes, were short clipped words of unmistakable meaning which could be uttered rapidly and which roused the minimum of echoes in the speaker's mind."

Much of that, I think, would be right at home in many a Madison Avenue copywriter's or political spin doctor's office. The only part that seems out of place is the reference to "exactitude of meaning," which in our culture tends to be more often sneered at than sought after.

One thing Orwell didn't anticipate was the internet, which, like many technologies, is a two-edged sword. Governments have great ability to search and control, but millions—and perhaps soon even billions—of others have the ability to publish their own opinions and allegations. It would now be very hard for a government to keep updating a single official version of history and have everyone believe it. Too many others can put out their own versions. On the other hand, it's hard to recognize what in that flood of information is worth believing. The vast majority of it is still subject to the same limitation as official news stories: most people have no way to check it for accuracy.

The internet and other electronic media also make it easy to have not just one official Big Brother, but millions or billions of them. Recently we've heard numerous suggestions for official programs encouraging citizens to spy on one another and report "suspicious activity." Search engines make it easier than ever for ordinary citizens to snoop. One particularly egregious "service" will provide a physical address—and a detailed map for reaching it!—for any phone number entered. (To its [minimal] credit, the organization in question lets people opt out of being included in that "deal," but they can only do that if they stumble onto the knowledge that it exists. It

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shouldn't be offered at all.)

One of the most hotly contested provisions of the recent "Patriot Act" allows the United States government free access to anybody's records of library usage. Librarians are required to turn such records over on request, and forbidden to tell patrons that such a request has been made. Thus every librarian in the country has been made an involuntary deputy, forced to assist in police activities whether they approve of them or not—and I have yet to meet one who's happy about it.

As in the earlier trend toward indiscriminate use of surveillance cameras in public places (which I cautioned against in "Technological Temptation," November 1999), we are told in defense of such measures that "Only criminals have anything to fear." I suppose some people find this assurance comforting, but doing so seems to me to require a remarkable level of naïveté. Remember, first of all, that governments define what's criminal. "Criminal" just means "violating a law"; laws are made by governments, and governments are composed of fallible and sometimes corrupt human beings. Opposing Hitler—or King George III—was a crime, as defined by the laws of their time and place; that does not mean it was wrong.

Remember further that people are not infrequently accused, for all kinds of reasons, of crimes they did not commit. Even if due process is fully operational and they can eventually clear their names, doing so can put their lives on hold for years and may scar them permanently. Remember also that due process does not guarantee justice, though it does improve the odds; criminal cases are often decided on the basis of evidence so inconclusive that juries deliberate for days or weeks about what it means. And remember finally that governments are ultimately in charge of collecting and evaluating evidence about accusations, and that sometimes—e.g., in times of declared emergency—due process is *not* guaranteed.

Put all these things together and consider that a more accurate statement of "Only criminals have anything to fear" is "Only people *accused of being* criminals have anything to fear." Sounds a whole lot less comforting, wouldn't you say?

So we can't be smug. 1984 may well be the year that comes late, if we let it—but maybe we don't have to.

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This is an excellent time to ponder this brief quote from the 1987 *Encyclopædia Britannica*'s main article about "Technology": ". . . the fact that high technological competence requires . . . a high level of educational achievement by a significant proportion of the community holds out the hope that a society that is well-educated will not long endure constraints on individual freedom and initiative that are not self-justifying. . . . given sufficient time without a major political or social disruption and a consequent resurgence of national assertiveness and human selfishness, there are sound reasons for hoping that technology will bring the people of the world into a closer and more creative community."

Since that was written, we have, of course, experienced such a major political or social disruption, and thereby been plunged into a time of heightened danger. Some of the dangers are obvious and very much in every day's news. The less obvious ones may, in the long run, prove more important. The potential envisioned in the *Britannica* article still exists, but we must be particularly mindful that it depends crucially on widespread, high-quality education. Meanwhile, other potentials also exist, and we must be particularly careful not to let them be realized. As a start, this might be an excellent time for anybody who thinks the danger is past or "it can't happen here"[1] to read or reread *1984*. ■

[1] Which, by the way, is the title of another book, by Sinclair Lewis, which also warrants a look.

In all affairs it's a healthy thing now and then to hang a question mark on the things you have long taken for granted.

—Betrand Russell

Education is the ability to listen to almost anything without losing your temper or your self-confidence.

—Robert Frost

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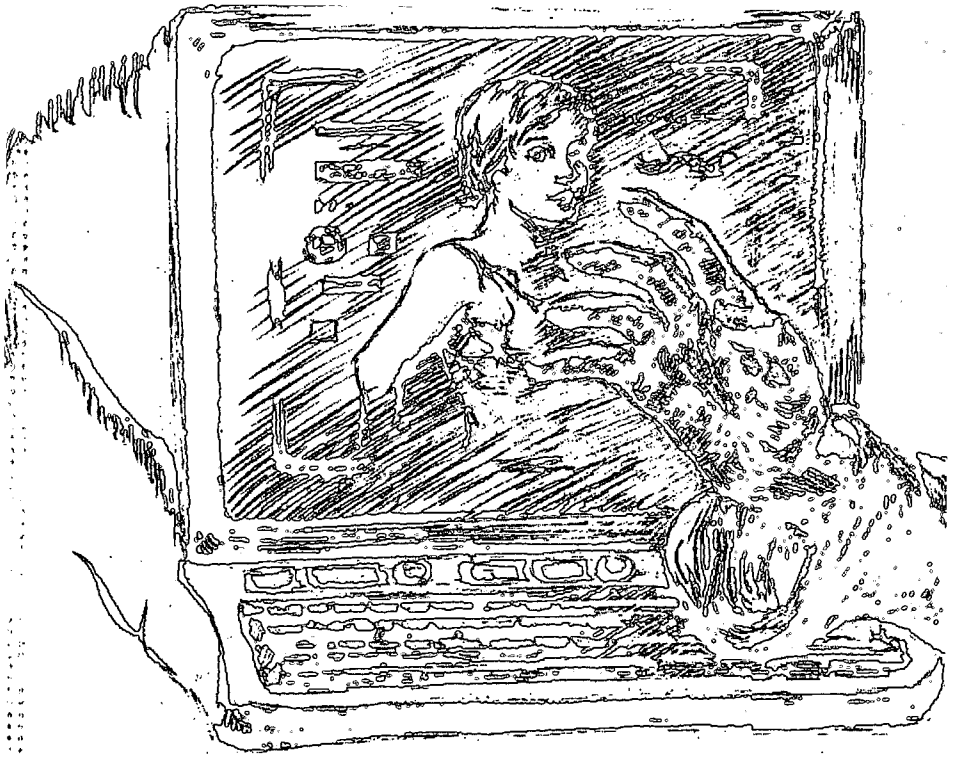

Tea with Vicky

Pete D. Manison
Illustration by Beryl Bush

What would you do
if all your "might-have-beens"
were placed within your reach?

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Vicky shimmered. Fear evolved into anger, then indignation. "What gives you the *right?*"

Words spun to hurt, hitting targets in Jessica that the younger woman didn't know existed. "I told you," she said. "Wait for the overlay. It'll all make sense in a moment."

Around them, the darkened lab seemed to listen, as if an unseen audience sat watching the spot-lit table with its checkered cloth and identical glasses of iced tea. Use of the TRV had been giving Jessica that sensation more and more of late, as if hidden eyes watched her. This was certainly no more than a side effect of her work, in which *she* was the watcher, spying on the lives of people who remained completely oblivious of her presence.

Vicky stiffened, one hand going to her cheek in a mannerism Jessica had begun to anticipate. Then, as the memories of their past encounters settled in, her green eyes began to look less like hard glass and more like twin emerald lakes.

"I . . . see," her daughter said. "I had no idea."

Jessica smiled. These first moments after a grab were always tense. Viewing was passive, unsensed by the target. But when the TransReality Viewer was used to enable a grab, the subject quite naturally reacted with alarm, sometimes violence. And when it was her own child, the difficulties multiplied.

"Then you remember who I am, where you are, everything?"

Vicky nodded, eyes flicking left and right as she evaluated the new inner landscape. "Incredible! It's . . . wonderful."

Jessica smiled. "Try your tea," she said gently.

Vicky's eyes sparkled as she wrapped slender fingers around the condensation-fogged glass. This was a ritual game, part of what had become the most meaningful event of Jessica's week. Only on Thursday night did she have the lab to herself. The cleaning crew's night off—put to good, if highly illegal, use.

Vicky took a sip, swirled the liquid around in her mouth. She looked so solid, so real, it was hard to believe she would cease to exist were she to step outside the TRV's projection field.

"Green tea . . . with lemon and honey . . . and . . . Is that ginseng?"

Jessica smiled in approval, but shook her head. "Ginkgo Biloba. You got everything else, though. Not bad."

"For an alt-person, you mean."

Jessica frowned. "We've been through that, remember? You're real, back in your universe—as real as I am here."

Vicky nodded, took another sip of tea. "I know, Mom. But *this* me"—she touched her chest—"is just a facsimile, right? A cut-and-paste copy. Temporary. Disposable. I exist only for this conversation, and when you turn off the machine I'm gone. My original back in my reality continues her existence uninterrupted, with no idea that any of this happened."

Jessica looked down, took a drink from her own glass to postpone having to answer. Their time together was so brief, so precious. To waste it speaking of such things . . .

"Does it bother you?" she asked. "I wouldn't bring you here if I thought it made you uncomfortable."

"No," Vicky said quickly. "I didn't mean that. It's just weird, you know? One minute I'm in my dorm room studying for an anthropology exam, the next . . ." She snapped her fingers and whistled eight notes from *The Twilight Zone* theme.

"I know it must be unsettling. That's why we developed the memory overlay. Repeaters yield the best information, but it got tedious explaining it to them each time."

Vicky ran a hand through her hair—hair that, while shorter than Jessica's, shone with the same auburn luster. "Is that why you bring me here? To pick my brain about my version of reality?"

Jessica frowned. "No, honey. This is

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strictly personal. I enjoy talking with you. I like to hear about your life, your dreams, what you love and hate, what passions drive you."

Vicky beamed. Jessica felt that swelling in her chest that came only in these times, when a place that had lain empty for twenty long years was suddenly filled.

Her daughter told her of mountain biking across the New Mexican desert, of weekend outings with the archeology club, of a secret crush on an older classmate. Jessica hung on every word, drinking in the enthusiasm, the zest for life, the eagerness and sense of boundless possibility that only a twenty-year-old can possess.

On her other visits, Jessica hadn't let it hurt her feelings when Vicky had failed to ask about *her*, dismissing it as self-absorption typical of that age, but this time Vicky surprised her.

"Enough about me, Mom. What about you? You're a scientist, that much I know. And you like tea . . ."

They giggled, their laughter so alike they might have been sisters.

Jessica swallowed. "Well, there's not much to tell. I'm single—divorced after a brief marriage back in my twenties, and never remarried. I love my work, though the security's gotten a little ridiculous since the university gas attacks."

"Since the what?"

Jessica told her what she knew of the incident, which wasn't much more than a week of CNN had provided at the time. Her university, thankfully, had been spared, but the whole staff had lost a week's work while every millimeter of the campus was searched.

Vicky nodded. "I remember reading something about a plot," she said. "But in my universe they caught the guys before they could pull it off. Some clerk at a pool supply store recognized one of the terrorists from an FBI poster when he tried to purchase a large quantity of chlorine."

Jessica made a mental note. These discrepancies fascinated her. "But this is supposed to be pleasure, not business. Tell me more about this upperclassman of yours."

And so they spent the next two hours, sipping tea and filling each other in on the details of their lives. Jessica kept it mostly about Vicky, diverting her when she asked questions that might lead toward the one subject she was not yet willing to discuss.

All too soon, it was time for goodbyes.

"Thanks for having me," Vicky gushed, touching Jessica on the wrist and winking. "Simply *love* what you've done with the universe."

Jessica smiled. "Then you won't mind if we do it again?"

"I'm counting on it. Next Thursday, right? I'll clear my schedule."

Jessica kissed her forehead, her lips tingling against the pseudomatter. Then she moved quickly to the control console. This part was never easy.

"Bye, Mom," Vicky said. "I love you."

Jessica said nothing, not wanting to spoil the moment with tears, not wanting her daughter to hear the quiver in her voice. When she reached out to press the dissolution button, it always felt like she was aborting her all over again.

Most people rank Monday as their least favorite day of the week. For Jessica Tengler, it was Friday. Ever since her Thursday night sessions with Vicky, Friday had seemed slow and tedious, an anticlimax during which her work held little interest and her mind incessantly replayed the previous night's encounter.

Not that the work was dull. To the contrary, they were tuning into fascinating alternate realities every day. Beagle's group was studying an alt-universe in which the asteroid that killed the dinosaurs had *missed* the Earth. These millions of years later, the saurians had evolved into man-sized, technological

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creatures who built cities and sailed the oceans and dreamed of traveling to the stars. Their level of advancement was roughly that of the steam age, and though Beagle himself declared they would never make a grab from this universe—the species barrier and all—Jessica felt certain it was only a matter of time before a saurian stood shimmering in the projection field, raising as many questions as he answered.

Her own team was currently engaged in a research project. Each alternate reality occupied a discrete niche in a hyperspatial architecture. Taking our own reality as the center, the closer a universe fell to it, the more it tended to resemble present-day Earth. And while study of vastly different realities was fascinating, the most useful information tended to come from universes closely resembling our own. Jessica's team sought to catalog these realities, to create a kind of map. Future grabs would be aimed at obtaining technology and science from closely aligned universes, with the goal of combining knowledge from a variety of realities to accelerate our own advancement. Washington loved the idea, and while Jessica enjoyed the pure exploration the TRV made possible, it was the grant money tied to the acquisition of new technology that drove all the peripheral programs.

Around noon, Nat Childers popped his head into her cubicle. "Hey, Jess. How goes it?"

She answered without looking up from her terminal, where the three-dimensional map of the reality tree rotated hypnotically. "Oh, it goes. What can I do for you?"

Nat was her team's coordinator, which meant that he liaised between her teammates and the professor. He was balding, had hands twice the size they should be, a voice to match, and liked to refer to the professor, though never in his presence, as Jeff.

"Jeff wants those coordinate logs by the end of the day. Any problems?"

"None. I'll get on it right after lunch."

He smiled, his teeth so white against his salon tan that they made Jessica want to dive for the sunglasses. "Actually, I've been in a meeting with Jeff all morning myself. Maybe you and I could step out for a bite?"

Jessica shook her head. "You never give up, do you?"

Nat made that clicking sound she found so annoying. "You know me. So you may as well give in now and save us both a lot of trouble."

She did glance up then, giving him her best I-know-how-to-press-sexual-harassment-charges look. "Nat, I'm sure there's an alternate universe out there somewhere in which I find you absolutely irresistible." She made his little *click* sound, pointing her finger at him like a pistol. "Fortunately, this isn't it."

"Ouch," he said, clutching his chest. "I'm shot."

She returned her attention to the screen, rubbed her eyes, entered the hyperspatial coordinates of another universe and assigned it an icon. Only when a shadow fell over her desk did she realize her coworker had not left.

"Can I *help* you with something, Mr. Childers?"

He leaned forward to look at the monitor, then turned his gaze on her. "Just concerned for a team member, Ms. Tengler. You seem a little tired. Not overdoing it, are you? Taking your work home with you? That sort of thing?"

Her hand trembled over the keyboard. She withdrew it quickly, hoping he hadn't noticed. "I'm fine," she said, smiling. "But thanks for your concern, Nat."

The charm worked, and he finally left her alone. She held out her hand and looked at it. The tremors were getting worse. She wasn't eating right, wasn't sleeping. She'd once been praised almost daily for her intuitive flashes, her leaps that had, in the professor's own words, taken them in days where careful thinking would have taken them in

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years. But weeks had passed since she'd contributed anything meaningful. People were beginning to notice.

She looked back at the monitor. Suddenly the rotating points of light meant nothing to her. The more she stared at them, the more they made her dizzy.

I need a break, she thought.

She opened the top drawer of her desk, took out two caffeine pills, and swallowed them dry.

Jessica retouched her makeup, experimented with putting her hair up, decided to leave it down. The black dress? No, the green—it matched her eyes and complemented the highlights in her hair.

Only when everything was perfect did she cover it all with the nondescript trench coat she'd bought at the secondhand store. Then, in evening's gathering darkness, she crossed the campus to the physics building, ignored by amorous young couples who strolled in the lamplight or others who bent into the crisp October wind intent on errands the nature of which she could only guess.

Past the security checkpoints, where a swipe of a card worked miracles, and finally into the lab.

Thursday night solitude. Computers labored, silent but for the clicking of their hard drives as they massaged the data gathered during the day. A cursory check verified that no one was working late. Jessica moved to the TRV, removed her trench coat, and set up the folding table and chairs. She used a Bunsen burner to heat the water for tea, and while it was heating she activated the machine.

A subsonic hum filled the air. Static electricity stood the tiny hairs on her forearms and at the back of her neck on end. The viewer crackled with the exact sound a TV set makes after you've just turned it off.

Jessica tuned in the coordinates by memory. The screen flickered and steadied, showing a lab that was clearly *this* lab, but instead of the TransReality Viewer, some ungainly contraption of spiraling glass tubes filled the space. The same spatial coordinates greeted every operator regardless of what reality was being viewed. From there it was simply a matter of moving knobs and changing the physical viewpoint, exploring the world like a ghost.

Beyond the city, she flitted through the black desert night. She found Roswell, spotted the university, flashed past it to the dormitory. Vicky's room was empty. Jessica's pulse quickened. What if she couldn't find her?

She tried across the hall, where her daughter sometimes went to hang out with her girlfriend, Yolanda. Yolanda was there, but when Jessica caught a glimpse of bare skin and the muscled male abdomen rising up between open brown thighs, she quickly twisted the knob and moved the viewpoint outside.

There.

Two figures walked along the reflecting pool, their faces moonlight pale. Vicky was laughing at something the boy was saying. In observation mode, the TRV displayed only the visual image, so Jessica had no idea what they were talking about. It didn't matter. This was merely the preliminary stage. Now that she had a target, she locked it, waiting while the computer prepared to make the grab.

After ten seconds it beeped, and the image of Vicky appeared bracketed in a flashing green box. Jessica pressed the red button on the console. At once the elevated circular pad in front of the viewer began to pulse with pent-up energies. A swirling pattern of white lights formed above the pad. The lights spun faster, deepening in color from white to yellow to red as they drew closer together, and then with a suddenness that still startled Jessica, her might-have-been daughter Vicky stood blinking in confusion, her arm outstretched where she'd been holding the boy's hand.

"What . . . where . . . who the hell are

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you? You look just like my . . . *mom?*"

Jessica moved forward with the practiced nonaggressive gait her team had developed for these encounters. Visitors presented no physical danger until she stepped onto the pad within their existence-radius, but psychological damage presented its greatest threat in the first few seconds.

"Yes, Vicky, it's me. Please have a seat. I know this is confusing, but it will all make sense in a moment."

Vicky remained where she was, moving only her eyes. "Sense? Oh, yeah, this makes perfect sense. I'm walking with Brian, he's doing his impersonation of Professor Locklear, and then whoosh, I'm beamed aboard the Starship *Excalibur* and who is the captain but my own dear mother." Vicky squinted as Jessica drew nearer.

"Except Mom wears her hair short like mine. And I've *never* seen her wear a dress. And your skin . . . You look—pardon me for saying so—*older.* Like you've been through hell and back. But you *are* my mother . . . aren't you?"

Jessica smiled. "Yes and no. I'm the Jessica Tengler of another reality. We're experimenting with a device called a TRV. It allows us to explore alternate realities, worlds existing in parallel with our own. Every possible event creates—"

Vicky held up a hand for her to stop. "So you just reached in and *took* me? What gives you—"

"—the right. I know. You always say that."

"Always? I don't understand. I've never been here before in my life. I'm sure I'd remember."

"Please, Vicky, take a seat. I've prepared us both a nice cup of hot tea. It will all make sense presently. Trust me."

Vicky hesitated. The dynamics of this opening bit were always different, depending on her mood just prior to the grab. This time she was taking it particularly well. She'd been relaxed, at peace, walking by the reflection pool with Brian.

"Well, I guess there's not much I can *do* about it." She pulled out the chair and sat, and Jessica moved up to take her own place at the table. "So if we've done this before, why don't I—"

Jessica saw the change in her daughter's eyes as the memory overlay kicked in.

"Oh. I see."

"Hello, Vicky. It's good to see you again."

Vicky smiled. "Has it been a week already? Time flies."

"When you're having fun?"

She blushed. "I guess you saw Brian on the viewer. Isn't he a dream?"

Jessica made a noncommittal grunt. "Honey, I'm just concerned. Your friend Yolanda—"

"Oh, her and that football jock of hers are going at it every night now. You didn't—"

"Just an accidental peek, dear. But it was enough to get me worried that—"

"*Mom.* I can't believe we're having this conversation. Brian and I are just friends. So far, anyway. And if it becomes more, well, just because they cured AIDS doesn't mean I'm not careful."

Jessica's breath caught in her throat. "Cured AIDS, have they?" She made a note to have the team run down the details. One more payoff for the program.

Vicky took a sip of her tea, blew on it, took another sip. "Mmm. This is a nice variation. Let's see. Morning Thunder? With real sugar and cream. And just a touch of cinnamon."

Jessica smiled. "That's my girl. I remember when I was a college student. I called this my coffee."

Vicky took another sip. "It packs a punch, that's for sure."

Jessica took in her daughter, noting the rosy flush to her cheeks, the extra sparkle in her green eyes. They usually only flashed that way when she talked about cross-country cycling or digging for pottery sherds. It hit her then.

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Whether Vicky admitted it to herself or not, she was falling in love.

It took her back to a time when she was even younger than her alt-daughter was now, when having a boyfriend was all that mattered, when saying no seemed riskier than saying yes. She'd been pregnant by seventeen. And when she made her decision, the boy who had said he loved her like the Moon loved the stars decided to leave, saying he couldn't be with someone who could do such a thing.

"Where'd you go?" Vicky asked.

Now it was Jessica's turn to blush. "Sorry. It's just that you remind me of myself when I was about your age. Tell me, how's your father?"

Vicky smiled, pride clear in her strong chin. "Jon's fine. So's Mom. He's gone to full-time writing again, and mom's selling her sculptures. They're happier than I've ever seen them. Not getting rich, mind you, but happy."

Jessica felt a pain in her chest. Jon. The love of her life. In Vicky's reality, he'd had no reason to leave her.

"Mom? Are you okay?"

Jessica forced a smile, took a sip of her tea. "A writer, huh? Jon always wanted that. I'm glad he's getting the chance to do what he enjoys."

"What about in this reality?" Vicky asked. "You said you were married for a while. To Jon?"

She shook her head, suddenly unable to raise her eyes from the tablecloth. "No. Your father and I dated in high school, but there was a . . . problem, and he . . ."

Cool fingers on her wrist. Jessica did look up then, to see Vicky's eyes focused to a sharpness that looked like it could drill through metal.

"Mom, what about me? Do I even *exist* in this reality?"

Jessica felt a cold knot in her stomach. Her greatest fear had always been that Vicky would hate her, would reject her when she learned that in this universe her mother had chosen to terminate her. She'd rehearsed it a thousand times and never found a way of telling her that didn't make her sound like a cruel and selfish bitch.

Now she looked into her alt-daughter's face, looked at the hunger to know the truth, and she simply couldn't do it. Carefully, she changed the subject. Vicky went along with it, but Jessica knew her curiosity had been aroused. It wouldn't be long before the subject arose again.

What she would tell her then, she had no idea.

The next morning, Professor Muzyka called Jessica into his office.

"Nice work on the AIDS cure lead," he told her as she sat across the desk from him. Muzyka was a large man with a deep voice that sounded like he was threatening you even when he praised you.

"Thank you, sir. It shouldn't be too difficult to grab a doctor and get the details of the treatment."

Muzyka nodded. Clearly this was a break for the TRV program. If the cure panned out, funding would cease to be a problem.

"There's just one thing I don't understand," the professor said. "Childers brought it to my attention. You said the information came from a universe designated HC-170795. But those coordinates aren't on any of the logs. According to our records, that reality's never even been viewed, much less grabbed from. How do you explain that?"

She sputtered and she fidgeted and by the time it was over she felt very sure the professor was onto her.

"Maybe we should stop for a while. I don't want you getting into trouble." Vicky looked genuinely concerned, her chamomile tea untouched in its cup. "Mom, what aren't you telling me? Why is it so important that you bring me here? Why does it have to be in secret, at night, on Thursday, so even the clean-

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ing staff won't see?"

It was coming, and there was nothing she could do to stop it. "Vicky, I bring you here because I need the contact. I need . . ."

Soft fingers touched her cheek, pushed a stray lock of hair away from her eyes. "Mom? It really bothers me to see you so unhappy. Has your life been so terrible? What can I give you that your own—"

She stopped, her eyes widening.

"Vicky, you asked me about yourself in this reality. I didn't quite know how to tell you."

Vicky swallowed. "I don't exist here. That's why you bring me. I was never born."

Jessica forced herself not to look down, though eye contact brought pain. "I've been wanting to tell you, but I guess I lacked the courage."

Vicky smiled. "It's okay, Mom. No wonder you take such risks to see me. I'm . . . flattered, really. In this reality, you broke up with Jon and never had me. It's hard to get used to the idea, but there's nothing wrong with it."

Jessica clenched her teeth, let out her breath in a long, slow sigh. "No, Vicky. It wasn't like that at all. You see, Jon *did* get me pregnant. I was only seventeen and I had such plans for my career. I couldn't have a baby. I just *couldn't*. And Jon, he never forgave me."

Vicky's face had gone pale.

"So you see why I need you to understand, Darling. I regret what I did and this way—"

"This way you don't have to pay for your crime. You can still have a relationship with the daughter you murdered."

"Vicky!"

"Well, that's what we call it in my universe. Abortion was outlawed a generation ago. It's punishable by death."

"But Vicky, here, now, things are different. Politics. Public opinion. They're still debating—"

"Which makes it *right?* My God, what a hypocrite you are! You kill me, and then you still want to *talk* to me?"

"Vicky, please. It's been so hard. And when I found a reality where I hadn't had the abortion, where you *did* exist . . ."

"You just had to grab me and burden me with the knowledge that my own mother was a murderer. If *you* did it, she must have at least *thought* about it."

"Vicky, don't."

"Did you ever think about *me?* Did you ever wonder what it would be like to be transported to a universe where you were never born? Where your mother didn't want you?"

She broke off, tears glistening in her eyes. Jessica wished she could crawl under the table and die.

"This is very hard for me, Victoria. I need you to understand. I also feel that what I did was wrong, but I was seventeen years old. Haven't I paid enough? I lost Jon, I lost my self-respect. I have nightmares, Vicky, terrible nightmares."

Vicky's tears had vanished. Her eyes were wide with hate. "So now you want forgiveness. Tell me something. Do you have trees in this reality?"

"Of course."

"Good. Then go climb one."

"Vicky."

She got up from the table so suddenly that she knocked over her cup. A dark stain slowly crept across the table. "Send me back! I don't want to be here! Well, go on! Flip the switch and end my existence. You've done it before."

Jessica trembled. "And every time it's like I'm killing you all over again."

Vicky flashed a grin like a lethal weapon. "They say it's easy after the first time."

Jessica couldn't move. "Let's talk about this. I don't want you to go until we—"

"So now I'm your prisoner? I don't think so. You believe in a woman's right to choose? Well, so do I!"

With the last word she leapt off the pad, out of the projection beam, and before Jessica could get to her, it was too

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late. The pseudomatter dissipated as soon as it left the field of the TRV.

Jessica stood in silence for a moment. Then she picked up her teacup and screamed, throwing it across the room where it shattered against the wall.

Jessica had never touched liquor. Her father had been a hardcore alcoholic, not to mention a chain-smoker, and she'd learned early that the addictive personality was inherited. Tonight she threw caution to the wind. Three whiskey shots later, she wondered why she hadn't tried it sooner. This delving into what might have been was just as much an addiction, wasn't it? This torturing herself for the one mistake of her youth was just another way of slowly poisoning herself to death.

Strange how clarity sometimes came from intoxication. By narrowing the focus of her attention, she gained the illusion of deep insight into the problem that most troubled her. Guilt. She'd let it build up to the point where it had blocked her. She couldn't go forward in her life until this was resolved. Yet how could she resolve it when the person for whom she grieved crystallized before her every Thursday night?

If I had the strength, she told herself, *I'd never bring her here again.*

"If I had the strength," she heard herself say out loud.

She saw then that she was destroying herself, that the only way to save her career, perhaps her life, was to walk away now.

She remembered Vicky, sitting across from her, remembered her laugh, her trim, athletic body, her New Mexican tan, the way her eyes sparkled when she spoke of her hopes and dreams—hopes and dreams that could never come true in this reality, where she had been murdered when she was a defenseless cluster of cells.

Another drink.

And another.

Jessica remembered her father, sprawled out on the living room floor and laughing at things only he could see. She smiled, feeling warm and soft.

Understanding at last.

Vicky killed herself the next seven times, flinging herself out of the projection area. But each time, the memory overlay inched forward just a bit, and it seemed to Jessica that her daughter's scream of outrage lost its edge. Still, three months passed before she sat once more across the table from her.

"I'm sorry, Mom. I shouldn't have said those things. I shouldn't have done . . . that. It was a shock, that's all. I needed time to adjust."

Jessica fiddled with the spearmint leaf that rode high on the ice at the top of her glass. "I should be the one apologizing. I shouldn't have sprung it on you so suddenly. I've been told I lack a certain subtlety."

Vicky shrugged, not denying it.

Jessica put her hand to her face, suddenly ashamed of everything: the abortion, the loss of Jon, the addiction to these weekly forays into what might have been. The hangover didn't help, reminding her of the new habit. She felt worthless.

"Mom."

Vicky had reached out to touch her wrist, gently pulling her hand away from her face. Jessica looked at her alt-daughter and wondered what she saw: a failure, a coward, a murderer.

"Mom. Don't do this to yourself. You did what you thought was right. Like you said, we come from different realities. I can't judge you by the standards of my own world. You probably felt like you were making a noble sacrifice, giving up motherhood and marriage for the sake of your career."

Jessica stared ahead, saw nothing. "A mistake. I should have found another way."

Vicky shrugged. "Unless you guys have invented time travel as well, there's nothing you can do to change it now.

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Let go of regret. It's poison, mom. It will destroy you."

Jessica took a long, shuddering breath. "Then you forgive me?"

Vicky frowned. "The question is, do you forgive yourself?"

Jessica shook her head. "I was selfish. I wasn't thinking of anyone else. Who knows what I deleted from this world when I aborted you? What did I think gave me the right to decide a life should never exist?"

Vicky never broke eye contact. "People who practice celibacy could ask themselves the same question. How many sperm are expelled when a man ejaculates? Millions? Does male masturbation equal mass murder?"

"It's just words, Vicky. It doesn't mean anything. What I need—"

"What you need, I can't give you. How can I forgive you for what you never did? From where I am, you didn't *have* the abortion."

"Vicky, please, you—"

Footsteps in the hallway made her turn. The lab door slammed open, and suddenly campus police swarmed everywhere. Out of the maelstrom, two figures emerged: Nat Childers and Professor Muzyka.

"You see, sir," Childers said, pointing excitedly. "I *told* you she was up to something." Then, to Jessica, "Caught you with your hand in the cookie jar, didn't we?"

"Mom?"

Jessica glanced at Vicky, tried her best to sound reassuring. "Don't worry, Victoria. I'm sure they'll listen to reason." Then, turning to the two men: "How did you know?"

Childers smirked. "A careful reading of our electric bill was all it took to pinpoint unscheduled TRV use in a suspicious pattern. Then, with a little detective work on my part, the rest fell into place."

Jessica mentally kicked herself. Of course! The device drew enough power to light half the campus every time it was activated. "Please," she began, "it isn't what you think."

Childers had already moved to the controls. Muzyka stood behind him, glowering at her.

"Sir," she started, "I can explain. I—"

The professor held up a hand to silence her.

Childers said, "Shall I terminate contact, sir?"

Muzyka looked from Jessica to Vicky, eyes glittering, no doubt recognizing the similarities in build and coloration the two women shared. Childers turned to look at the professor, who nodded once.

"Nooo!" Jessica screamed.

Too late. Childers had already hit the dissolution button. Jessica watched as her daughter was undone before her eyes, leaving only her fingerprints in the condensation on her glass of mint tea.

It was funny, Jessica thought as she sat alone in her apartment, how quickly the world could come crashing down. It almost seemed inevitable, when she looked back on it. Her destruction seemed to be what the universe had wanted all along.

Professor Muzyka had suspended her pending an investigation. Her security pass had been confiscated, the codes to the lab changed, and a restraining order issued. She was barred not only from the lab and TRV, but from the entire campus.

Childers! He'd orchestrated the whole thing, spying on her, delivering the proof to Muzyka, probably even suggesting the raid to catch her in the act. How could either of them understand what she was going through? Sure, she'd abused her access to the TRV. But what harm had she done? She hadn't sought knowledge of some science or technology she could use to gain fame or fortune. She'd only wanted emotional closure.

And she'd been so close!

"No," she said aloud. "I refuse to accept this."

The whiskey bottle beckoned from

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the kitchen counter, but she ignored its call. She needed a clear head. Attainment of her goal had become more difficult, but it had not become impossible.

She set to work, planning it with the thoroughness of a jewelry heist.

Thursday night. Dressed in her faded trench coat, Jessica Tengler moved along the sidewalks of the campus. She'd wrapped her hair into a bun and hidden it under a baseball cap. She'd used makeup to alter her features enough that she barely recognized herself. Under one arm she carried textbooks.

She passed a security officer, who didn't give her a second glance, so she never got the chance to find out if her fake student ID would pass muster. At the physics building she hit a snag.

"Oh, shit."

She kept walking, avoiding eye contact with the agents who stood at the front door. She hadn't counted on this. Muzyka had gone to the feds, or maybe they'd come to him. That was probably it. He'd reported the incident, and they in their infinite paranoia had sent a couple of agents to make sure no one tried to steal the TRV.

It made sense. One more step along the road to Area 51. As long as it was experimental, such a device could remain the property of a university physics department. Now that it had started to prove itself, greedy government hands stood poised to grab it and make it disappear. She'd seen this day coming; she just hadn't expected it to come so soon.

Jessica rounded the corner, glanced back, and sighed with relief when she saw that no one was following her.

Time for Plan B.

She took a breath to steady her nerves. Once she did this, there would be no turning back. Assault of federal agents would bring serious prison time. Still, it wouldn't matter. If she got in, got access to the TRV one last time, just long enough to talk to Vicky and make her understand, to hear the words she had ached to hear for so long—if she did all that, she didn't care what happened next.

A tiny voice whispered that her career would be finished, that she'd be an old woman before she tasted freedom again, that this was absolutely the stupidest thing she had ever done. Capture wasn't simply probable; it was inevitable.

I don't care, she told the voice. *I have no choice.*

Without closure, what would any of the rest of it matter? She'd sink into alcoholism, like her father before her. Perhaps she'd find the final answer the same way he had found it. No. Better to face this thing and finish it now, no matter what the consequences.

So Jessica made the block, and when she again approached the front of the building, she had the stun gun hidden in the palm of her hand.

There were two high hedges, one on either side of the sidewalk—the last concealment she would have. She swallowed hard, trying to slow the beating of her heart, and had nearly reached the point where she would emerge from the cover of the hedges when something strange began to happen.

It started with silence, as if the world around her had ceased to emit sound. The rushing of traffic on Einstein Avenue was gone. The chirping of the night birds was gone. Even the sound of her footsteps on the sidewalk had vanished.

Then she noticed the lights. The lamps along the sidewalk went from white to yellow to red, glowing like embers. The lights from the windows of the nearby buildings became so dim she could barely see them. When she looked up, she saw the Moon had become the color of blood.

And then she felt it. A tingling, starting in her extremities and spreading quickly throughout her body, like a million ants crawling all over her. *Am I having a heart attack?* she silently asked.

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Am I dying?

There was no pain, no difficulty breathing or tightness in her chest. Only a sensation of increasing pressure. And then, just as she began to suspect the truth, the world vanished, and she found herself standing in a circle of light across the table from a woman who looked very familiar indeed.

"Hello, Jessica."

Jessica blinked. The woman could have been her twin. Suddenly she understood the emotional reaction that always resulted from a grab. Even knowing what had happened to her, the primitive regions of her brain reacted with a fight-or-flight reflex to the shock of suddenly finding herself in this strange place.

But she *did* know. Taking a calming breath, she let her higher faculties prevail.

"So," she said to her twin, "our reality *isn't* the only one to develop the TRV. I can't say this comes as a total surprise. I mean, there are a virtually infinite number of realities out there."

The woman nodded. "I see you're as quick on your feet in reality HC-001371 as you are in this one. Please have a seat. We have important matters to discuss."

Jessica hesitated. "Are you sure we should be doing this? In my world we avoid self-interviews. Some theorists point to a danger if two versions of the same person meet."

The woman laughed, touched her hair. "Oh, my. I hadn't thought of that. You think I'm *you*. The time differential."

"Time . . ."

"Our TRV is a little more sophisticated than yours. And we've had it longer. We can view and grab from anywhere along the timeline, not only from the present. And when we *bring* you here, we really bring you here. Out of your time-space and into ours."

Jessica did sit then, not out of courtesy, but because her knees felt weak.

"Then you're . . ."

"Vicky. In this reality, I went on to continue your work after you were killed by an alt-Saurian. We've advanced our technology hundreds of years thanks to your concepts. We've cured most disease, solved our energy problems, and well . . . look at the view."

Jessica turned to the window and drew in a quick breath. Beyond the window, stars shone down on a stark lunar landscape.

"By grabbing the most advanced technology from thousands of alternate realities and combining them, we've taken our own reality so far into the future that we can now afford to adjust other realities, to correct problems we find there."

Jessica's head swirled, and for a moment she thought she would faint. "I see," she finally managed. Vicky pulled up a chair and leaned forward across the table.

"Mom, you are about to make a terrible mistake. By assaulting the federal agents and breaking into the lab, you give the government the excuse it needs to seize the TRV and use it for its own purposes."

"Which are?"

"Take a guess."

She felt a sudden chill. "Oh, God. Military?"

"That famous Jessica Tengler intuitive leap. By focusing on weapons research through the TRV, the government is able to develop an arsenal that makes the rest of the world look like they're using spears and slingshots. By using it to view closely parallel realities, their spies are able to find the enemy's weaknesses and exploit them."

"Result?"

"Let's just say that your reality joins all the ones where the Cuban Missile Crisis wasn't resolved, where the Cold War never ended, where Hitler developed the bomb."

"I see."

"All because you broke into the lab that night. And for what? To gain for-

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giveness for a crime that exists only in your mind? That you've paid for a hundred times over with grief? Mom, for every reality where you aborted me, there are ten where you didn't. *I'm* here. And Vicky from HC-17075. And an infinity of others."

Jessica frowned. "It doesn't matter. *My* Vicky still doesn't exist. I still aborted her."

Vicky hissed with exasperation. "Mom, I can't help you if you won't help yourself. Stop playing the victim long enough to understand something. Because of your self-indulgence, billions of people will die. Your Earth will become a radioactive hell-planet that won't support life again for three thousand years."

"You make it sound like I can just flip a switch and change the way I feel."

One corner of Vicky's mouth turned up. "Maybe you can."

And she used the TRV to show her:

Vicky in love, dancing with a young man in uniform, green eyes flashing with tears as he slipped the ring onto her finger.

Vicky triumphant, unearthing the remains of an Anasazi tomb hidden for hundreds of years and finally explaining the mystery of the tribe's disappearance.

Vicky in a spacesuit going EVA to repair the damage done by a micrometeorite impact.

Vicky receiving an advanced degree.

Vicky having her first child.

Vicky holding her dying mother's hand and saying, "I love you."

And many more: Vickys who made great discoveries, Vickys who invented revolutionary machines, Vickys who were happy and successful and who lived such full lives that Jessica looked at them with not only pride but also envy. All in the space of moments, the advanced TRV of this reality gave her all of this and more.

"Will I remember?" she asked when it had ended and she found herself seated once more across the table from this reality's Vicky.

Her daughter nodded. "We can leave you with impressions, knowledge of this encounter, all the emotional content. You won't remember every detail, but it will be enough."

Jessica wiped tears from her eyes. "Thank you," she said. "Thank you so very much."

Vicky touched her wrist, a gesture for all Vickys, for all realities. "Then you're ready?"

Jessica sat straighter, exploring the changes in her inner landscape. "Yes. Yes, I think I am." She started to rise.

"Not so fast," Vicky said.

Jessica raised an eyebrow.

"I can put you back whenever I like. We certainly have time for a cup of tea."

Jessica stopped. She had reached the point on the sidewalk where the hedges to either side dropped away. From here she could see the two feds who guarded the front entrance to the physics building.

She hesitated. The stun gun felt solid, somehow *right* in her hand. She remembered the urgency she had felt, the need that had driven her for so long. How could she just let it go now?

War, destruction, death. That would be the eventual outcome, according to the future alt-Vicky. But if there were infinite worlds where every possibility played out, what difference did it make what happened here?

She realized she'd been standing still for a conspicuously long period of time. One of the feds had noticed her and was beginning to move toward her.

Forward or back? Past or future? Life or death?

Jessica thought of Vicky. Once, she had denied her the choice of whether or not to be born. What would her unborn daughter say now?

Jessica knew at once. Dropping the stun gun into her pocket, she turned and ran.

Jessica touched up her makeup, ex-

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perimented with putting her hair up, decided to leave it loose over her shoulders. The black dress or the green? Definitely the green.

It had been an interesting year, she thought as she polished her nails. After her probationary period had ended without incident, she'd been fully reinstated. Since then, she'd carried out her duties with unquestioned efficiency, never letting even a hint of suspicion cloud the professor's face. She mapped new realities and located promising new discoveries, and never once did she return to the lab on a Thursday night to use the TRV for her own ends.

Not that she ceased pursuing a secret agenda. But this one was easier to conceal, and, if discovered, far easier to justify. By working from within to keep government involvement in the project to a minimum, she was helping to prevent the catastrophic future she had once nearly caused.

Jewelry. Jessica chose gold. It went better with the green, and this *was* a special occasion.

Finally, she was ready. She checked the time and ducked into the kitchen to grab two teabags and slip them into her pocket. Then she moved to the sitting room and waited.

It didn't take long for the familiar tingling sensation to begin. Her daughter was never late. □

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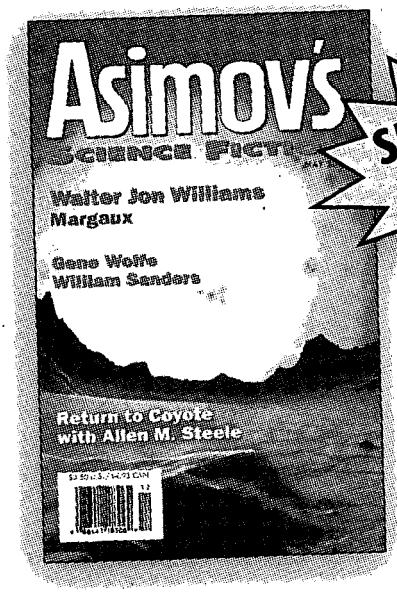

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SCIENCE FACT

FORENSIC SEISMOLOGY:

The Big Science of Minor Shake-Ups

Richard A. Lovett

On August 19, 2000, a dozen people were on a family reunion, camping beside a river in southern New Mexico. What they saw and heard isn't entirely known, but we can imagine much of it. Most likely, there was a noise like a clap of thunder, originating from a source two hundred yards from the campsite. Rocks and debris rained from the sky, but nobody was seriously hurt. Then, perhaps the dust cleared enough to reveal a crater twice the volume of an Olympic swimming pool where, moments before, there had been nothing but open ground.

Perhaps the campers gaped in wonder, trying to figure out what had happened. Perhaps they hit the dirt, like soldiers under fire. Maybe the concussion left them dazed, or maybe they heard the ominous hiss of *something* escaping from the pit. Possibly, they thought a volcano had chosen that moment to announce its presence and were waiting for the first sight of lava. Most likely, few of them realized that a weakness in a buried natural gas pipeline had chosen that moment to blow out, and that the real danger was wafting toward them on the breeze.

Seconds ticked by and nothing else happened . . . nothing until their world erupted in a gout of flame, accompanied by an apocalyptic roar that went on and on and on. In the crater, the temperature hit 2,200° F. At the campsite, it wasn't that hot, but it was hot enough. Some of the campers lived long enough to be rescued an interminable hour later, but all subsequently died of their burns.

Many people were involved in the ensuing investigation, but one of the more unusual was Keith Koper, an assistant professor of geophysics at Saint Louis University.[1] Koper is a seismologist, called in to help reconstruct the events that occurred during the blast and the resulting inferno. While other people dug through debris, Koper poured over

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vibrations recorded on seismometers up to 110 miles away.

Most people associate seismology with earthquakes—as well they should, because seismometers are the key instrument for studying temblors. Seismometers, however, are simply very sensitive needles designed to record vibrations in the ground.[2] They aren't picky about whether the source is an earthquake, a volcanic eruption, or the hoof beats of a wild horse. A team of researchers studying earth movements in the Andes Mountains, for example, was baffled by vibrations that were only observed at night. Earthquakes can occur at any time of day, so it appeared that their instruments were picking up something else. Eventually, the scientists realized that they were watching the trucks of smugglers, ferrying clandestine cargoes across a remote section of the Chilean/Argentine border. After studying the seismometer traces for a while, the scientists could even figure out the direction in which each truck was going, says Terry Wallace, a geophysics professor at the University of Arizona.[3]

Decades ago, seismologists would have been frustrated by such interference from human activities. Then, during the Cold War, defense experts realized that seismometers could be harnessed to monitor the other side's nuclear tests. Even if the tests were underground, the delicate needles of seismometers could detect them and produce information that could be used to calculate the yield from thousands of miles away. It was the birth of forensic seismology.

Seismology is a science that can be as simple or complex as you want to make it. In the vicinity of a major earthquake, it's pretty simple. There, everything—and everybody—is a seismometer, jounced around at the whim of powerful forces. In 1994, for instance, a friend of mine was living practically at the epicenter of Southern California's Northridge quake, magnitude 6.7. She first became aware of the earthquake when she awoke in midair between her bed and the floor, having been slammed by a shock that scientists later determined to have produced an acceleration more than 1.6 times the force of gravity. In the technical argot of seismology, such up and down vibrations are called Rayleigh waves, which ripple along the Earth's surface like waves on a pond, but my friend didn't need an expert to tell what had happened. She knew she'd been hit from below by what felt like a giant fist.[4]

Seismometers can be designed to record ground motion in any of three di-

[1] Keith D. Koper, Terry C. Wallace, and Richard C. Aster, "A Case Study in Forensic Seismology: The 1998 [sic] Natural Gas Pipeline Explosion Near Carlsbad, New Mexico," *Eos. Trans. AGU*, 83(47), Fall Meet. Suppl., Abstract S11D-04, 2002. This citation, and all others to *Eos. Trans. AGU*, refers to an abstract for a presentation at a meeting of the American Geophysical Union. Additional information is available at www.agu.org.

[2] Seismometers are also called seismographs. The related term *seismogram* is reserved for the tracing that these needles make on paper.

[3] This story and many other anecdotes contained in this article were told by Wallace and Koper at a press briefing and scientific symposium at the Fall 2002 meeting of the American Geophysical Union, Dec. 6-10 in San Francisco, California.

[4] A seismometer would instantly have quantified the size of that giant fist. When Alaska's remote Denali Fault unleashed a magnitude 7.9 temblor on November 3, 2002 (comparable in many ways to the quake that leveled San Francisco in 1906), geophysicists rued the paucity of monitoring stations closely enough located to measure accelerations directly along the fault. Such information could have been used to improve building codes in other danger zones. See Richard A. Lovett, "How Californians Benefit from Recent Alaska Quake," *The Sacramento Bee*, January 19, 2003, Forum, p. 2.

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rections: up and down (as in the jolt that threw my friend out of bed), side to side, or forward and back.[5] These motions can be quick jerks or prolonged shakings lasting for several minutes. They can be bursts of high frequency seismic noise or slower, steadier oscillations. Seismology gets complex when you start using the direction of motion and the frequency and duration of vibration to deduce the cause of the tremor. Explosions have seismographic signatures that "look" quite different from earthquakes, and the sluggish, stomach-rumbling vibrations from the movement of lava beneath a volcano don't look anything like what you'd get from a meteor impact.

Seismology becomes even more complex when banks of instruments are used in array to record the same event from different distances and directions. Currently, there are 16,000 permanently installed seismometers scattered around the globe, many of which upload their readings to the Internet, practically in real time. A big earthquake will show up on all of them; a technician's incautious door-slamming will appear only on the one being serviced. Events of forensic interest fall somewhere between the two extremes. To triangulate on the location of a seismic event, it needs to be strong enough to be observed by at least three seismometers. The more instruments that record it and the more broadly scattered they are, the more accurately the source can be pinpointed.

The Seismic War on Terror

Seismic waves travel at speeds of 2,000 to 16,000 miles per hour, depending on the type of rock through which they are being transmitted. That's fast enough that big events, such as major earthquakes, are felt by seismometers on the opposite side of the globe within hours. When earthquakes occur in remote areas, seismic readings can tell us what happened long before the first scrambled communications arrive from the stricken area.[6] In theory, the same could apply to non-tectonic events, such as meteor strikes, military actions, industrial accidents, or terrorist attacks. In practice, these events are usually observed by other means, and forensic seismology only comes into play after the fact, when investigators turn to seismographs to see what these records might reveal.

When Pan Am Flight 103 was brought down by a terrorist's bomb in 1988, over Lockerbie, Scotland, nearby seismometers recorded the stricken airliner's impact with the ground. In fact, seismologists identified six major impacts, indicating that the airplane had broken

[5] Although seismic waves can vibrate in any direction, there are several basic types. Two others of interest are S-waves and P-waves. The "S" in S-waves stands for "shear," which means that these waves vibrate perpendicularly to the direction in which they are moving. P-waves are "pressure" or "compressional" waves, which vibrate back and forth along the line of motion. P-waves travel faster than S-waves, allowing seismologists to use the lag between the arrival of the two sets of waves as a marker for how far any given seismic station is from the source of the signal. For this reason, P- and S-waves are also called "primary" and "secondary" waves due to the order of their arrival. For more on basic seismology, see *http://www.geo.mtu.edu/UPSeis/waves.html*, a web site of Michigan Technological University in Houghton, Michigan.

[6] In the era of cell phones and e-mail, seismometers are losing their traditional role as first-alert earthquake sensors. Nevertheless, there are plenty of parts of the world with limited electronic infrastructures. And big earthquakes can shatter even the best-developed communication systems. Also, seismic readings give a quick estimate of the scale of the earthquake—an estimate that will always be more accurate than the panicked reports first emanating from earthquake survivors.

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into that many large pieces before it hit. This was already evident from the pattern of debris at the crash site, but the seismic data allowed the scientists to do something more: they could calculate the kinetic energy of each of the six pieces. Comparing this to the weight of the fragments recovered at the site allowed a simple calculation of each piece's speed at the time of impact—information that came into play in reconstructing the explosion that ripped the jetliner apart.[7]

Similar seismic detective work was done regarding the sinking of the Russian submarine *Kursk* during naval exercises on August 12, 2000.[8] When Wallace and Koper heard the news, they rushed to download data from seismometers in Norway, Sweden, Finland, and Spitszbergen. Underwater explosions don't directly shake up the Earth's crust in the same way as earthquakes, bomb tests, or airline crashes, but they do produce shock waves that slam into the seabed, transmitting energy to the rocks below. When the *Kursk* sank, the Scandinavian seismometers recorded the event as equivalent to a magnitude 4.1 earthquake. These seismometer readings not only allowed U.S. observers to pinpoint where the submarine sank, but showed that the main explosion had been preceded, two minutes and 15.75 seconds earlier, by a smaller seismic event of about magnitude 2.2. To put that in perspective, the Richter scale is a logarithmic scale in which each one-point difference in magnitude corresponds to about approximately a 31-fold difference in energy. It's a testimony to the sensitivity of seismometers that the minute tremblings created by the sinking of the *Kursk* were discernable from so far away, even though the smaller of the two *Kursk* events carried only one ten-millionth as much seismic energy as the quake that threw my friend out of her bed.

Based on the physics of underwater explosions and Israeli tests of the efficiency with which this energy is transmitted into the seabed from explosions of various sizes, Wallace and Koper were able to determine how deep the submarine was below the surface at the time of the accident. Underwater explosions produce bubbles of hot gases, which oscillate as they rise to the surface. The frequency of these oscillations depends on the size of the explosion and the depth at which it occurred, allowing Wallace's team to determine (despite Russian claims to the contrary) that the cause was an explosion rather than a collision and that it had occurred at a depth of eighty-three meters (about 275 feet). The first blast carried a power equivalent to approximately 250 kilograms (550 pounds) of TNT; the second was equivalent to somewhere between 4,000 and 7,000 kilograms (about two to four tons) of TNT. Because the first explosion was about the size of the charge on a torpedo—and because the *Kursk* was known to be conducting a torpedo exercise at the time it sank—Wallace and Koper posit that the first explosion was a torpedo misfire. The second, larger one, they suggest, occurred when fire from that accident detonated additional warheads.

Shortly after the sinking, the seismologists noticed many small events, with

[7] See generally, David A. McCormack, "Seismology of Impacts," *Eos. Trans. AGU*, 83(47), Fall Meet. Suppl., Abstract S11D-02, 2002.

[8] Terry C. Wallace and Keith D. Koper, "Forensic Analysis of Seismic Events in the Water; Submarines, Explosions and Impacts," *Eos. Trans. AGU*, 83(47), Fall Meet. Suppl., Abstract S11D-05, 2002. See also Koper, K.D., T.C. Wallace, *et al.* 2001, "Forensic seismology and the sinking of the *Kursk*," *Eos* 82(Jan. 23):37, and Sid Perkins, "Explosions, Not Collision, Sank *Kursk*," Science News (online version), Week of Jan. 27, 2001, Vol. 159, No. 4.

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magnitudes between 1.25 and 1.86 on the Richter scale. These appear to have been depth charges dropped by the Russians to discourage other nations from sending scuba divers to spy out the secrets of the ill-fated submarine. The seismic readings were so precise that the researchers could even track the speed and course of the naval vessel used to lay down the underwater barrage. Based on the observed seismicity, it appears that the Russian depth charges were detonated at random depths, ranging from ten to eighty meters (the submarine was trapped at 107 meters). The scientists calculated that they carried charges equivalent to 112 kilograms of TNT—not too far off from what military experts believed to be the Russian munitions' true explosive charge.

Ever-vigilant seismometers were also on duty during the 9/11 terrorist attacks on the World Trade Center and the Pentagon. Because tall buildings are built on deep footings, energy from the impact shivered down the spine of these structures, directly into bedrock. The impacts were then recorded by seismometers as far as several hundred kilometers away.[9] The collapses of the buildings also produced seismic traces. These traces were so detailed that it is possible to identify the crash of each floor as the buildings pancaked downward in a series of rat-a-tat-tat impacts, each stronger than the one before as each collapsing floor added more mass to the falling debris.

Seismometers also recorded the impact of Flight 93 in rural Pennsylvania, confirming to authorities that (a) the plane was down, and (b) it had crashed intact, rather than exploding in midair. But seismic readings do have their limits. The plane that hit the Pentagon wasn't recorded by distant seismometers, probably because that low, sprawling building hadn't needed a deep foundation that coupled it so strongly to bedrock. And, unlike the Pennsylvania and Lockerbie crashes, this airplane was coming in nearly horizontally, and didn't directly strike the ground with all that much force.

The Forensics of Global Climate Change

Happily, not all uses of forensic seismology are as morbid as tracking the collapse of the World Trade Center's two towers. Vera Schulte-Pelkum, of the University of Colorado, has been examining Depression-era seismic records in search of the answer to an important question about global climate change: have the great storms of the North Atlantic Ocean become rougher and more frequent in the past century?[10]

Today, we monitor such things via wave-height sensors in ocean buoys. But those instruments haven't been used for all that many years. Seismograph readings date back to the 1930s. So far, the work is preliminary, but researchers such as Schulte-Pelkum have learned to tease from these records the faint, rhythmic signals of surf crashing on shore. That's not quite the same thing as direct measures of wind speed, rainfall, and wave height, but it's still a nice proxy for storm intensity. And even Depression-era seismometers were such remarkably delicate instruments that this data appears to be adequately preserved in their traces.

In those early years, however, seismometers were largely confined to active earthquake zones such as Southern

[9] Won-Young Kim, "Seismic Waves Generated by Aircraft Impacts and Building Collapses at World Trade Center, New York City and Shanksville, Pennsylvania on September 11, 2001," *Eos. Trans. AGU*, 83(47), Fall Meet. Suppl., Abstract S11D-03, 2002.

[10] Vera Schulte-Pelkum, Paul S. Earle, and Frank L. Vernon, "Detecting Ocean Climate Change in Seismic Noise: the Need for Directional Information," *Eos. Trans. AGU*, 83(47), Fall Meet. Suppl., Abstract S11D-07, 2002.

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California. And while the Pacific Ocean is important, global climate models are increasingly interested in the North Atlantic.

Obtaining Atlantic Ocean data from Southern California seismometers would seem to be insurmountably difficult, but amazingly, Schulte-Pelkum has found that these instruments actually do vibrate in response to the impact of storm-driven waves on Canada's Labrador coast, a full continent-breadth away. She's even developed a computer model that can point out the direction from which the wave noise is originating. This will allow her to examine the old traces to determine whether wave-impact signals originated from the nearby California coast or from Atlantic storms striking the continent's east coast so hard that the entire land mass rings like a seismic bell.

Waves aren't the only oceanic events that can be observed by seismology. In late 2000, a seismic monitoring network in Polynesia detected several episodes of strong activity coming from the Southern Ocean, producing signals that resonated at about four cycles per second.[11] At first, geophysicists thought the signals came from volcanoes—not an odd presumption, because underwater eruptions have previously been discovered in this manner.

Soon, the source was narrowed down to the Ross Sea, which lies near America's McMurdo Station in Antarctica. One of the world's largest active volcanoes, Erebus, is nearby, so the researchers figured that they were simply seeing that mountain's latest activity. But something was wrong: the volcano seemed to be moving.

Puzzled, the researchers tracked the signal for about 125 miles, at which point it disappeared. What, they wondered, could be moving across the Ross Sea at about 3.5 miles per day, producing volcano-scale seismic rumblings along the way?

It didn't take them long to come up with an answer. Earlier that summer, a big chunk of the Ross Ice Shelf had broken loose in a swarm of gigantic icebergs. The one that their instruments appeared to be tracking was 80 miles long, and the noise appeared to come from water-filled cracks that vibrated—either as the iceberg collided with neighboring behemoths or as its base dragged along the Ross Sea's shallow floor. Whichever of these was the exact cause of the noise, the moment the iceberg moved into deep water, the signal disappeared, confirming the scientists' belief that the large chunk of ice was indeed what their instruments were hearing.

Rumblings in the Air

Forensic seismology has two sister sciences, hydroacoustics and infrasound. Hydroacoustics involves listening to low-level noise in water—typically in the ocean. It overlaps seismology when these noises are transmitted into the sea floor, as in the sinking of the *Kursk* or the sounds of Antarctic icebergs, but it's also possible to conduct underwater investigations based solely on hydroacoustics. Because hydroacoustics offers a way to track submarines, it is a military technology that played a major role in the Cold War, glamorized in Tom Clancy's submarine novel, *The Hunt for Red October*.

Infrasound occurs in air. It is simply sound, pitched at frequencies too low for human hearing. Technically, it's any sound whose frequency is below 20 Hz,[12] but forensic applications generally examine frequencies in the range of 0.1 Hz to 4 Hz. This is the type of sound which, if it's strong enough, you feel as

[11] Jacques Talandier, Olivier Hyvernaud, and Emile A. Okal "Hydroacoustic Signals from Huge Icebergs in the Ross Sea," *Eos. Trans. AGU*, 83(47), Fall Meet. Suppl., Abstract S11D-09, 2002.

[12] The unit Hz, or Hertz, simply means "cycles per second."

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a palpable thump, but delicate instruments can detect it at far lower intensities. These instruments, called microbarometers, measure changes in air pressure as infrasound waves pass across them, and are so sensitive that they could detect the altitude-related air pressure difference between the top and bottom of a sheet of paper.

One use of infrasound is to detect aboveground nuclear tests—not of megaton-scale weapons (which are easily detectable by many other means), but of the smaller tactical weapons that are the ones most likely to proliferate. Currently, the Comprehensive Nuclear Test Ban Treaty Organization is constructing a 60-station global infrasound monitoring system, at an estimated cost of $35 million. Several stations are already operational, and—not surprisingly—they've detected infrasound from a sizeable number of non-nuclear events, opening the door for uses of infrasound that have nothing to do with nuclear monitoring.

Douglas Revelle, a scientist at Los Alamos National Laboratory, has long been interested in the collisions of the Earth with large meteors, often referred to as bolides. The most famous of these is the 6-mile diameter rock that appears to have struck Mexico 65 million years ago, widely believed to be the event that killed off the dinosaurs. But many smaller rocks hit the Earth each year, sometimes striking ground, but more often exploding in the atmosphere with resulting claps of infrasound.

Observing bolides by ultrasound isn't new. In 1908, an asteroid estimated to be about 125 feet in diameter exploded above the Tunguska region of Siberia, leveling forest for twenty-five miles in all directions and producing an infrasound signal so strong that even the crude barometers of that era tracked its pulse through three full circuits of the globe.[13]

The Tunguska bolide hit with an energy equivalent to a 10-megaton bomb—truly devastating if it occurred in a populated area. One use of the infrasound network is to collect statistics on the size of smaller bolides in an effort to refine our estimates of how often Tunguska-scale events might be expected to occur. Revelle has found that the upper atmosphere is repeatedly peppered by large explosions, ranging from less than a thousandth of a kiloton (the detection limit of the infrasound sensors) to the largest event the Test Ban Treaty Organization's infrasound monitors have seen to date, which struck in 1994 and packed a whopping 200 kilotons.[14]

Not surprisingly, the smaller the energy level, the larger the number of events. In a typical year, there are about thirty events in the 0.1-kiloton range and seven in the kiloton range. The best current estimate for Tunguska-scale events is that they occur about once every 1,000 years.[15]

Infrasound can also be used to listen to volcanoes. Each volcano has its own infrasound voice, says Milton Garces, an infrasound researcher at the University of Hawaii. "Some are operatic, and some are more like a colicky child." Garces' goal is to learn these mountains' infrasound languages, so he can distinguish the sounds of contentment from those of threat. "All volcanoes have a gas problem," he says with a grin. "Happy volcanoes release gas steadily, purring or

[13] Infrasound can propagate over vast distances before it attenuates to undetectable levels. Today's instruments would probably be able to track the Tunguska pulse through five or six complete circuits of the globe.

[14] To put this in perspective, an 8-foot rock would produce a 1-kiloton blast, depending on speed and trajectory.

[15] Reported in conjunction with "Listening to the Earth: Infrasound in Science and Nuclear Nonproliferation," symposium at the 169th Annual Meeting of the American Association for the Advancement of Science, February. 13-18, 2003, Denver, CO. Other scientists whose infrasound research is described in this article were also present at that symposium.

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rumbling. Unhappy volcanoes release gas explosively."

Even if infrasound never matures as a means of making volcanic eruption forecasts, it has already "arrived" as a means of monitoring remote eruptions. This is important, says Douglas Christie, of the Comprehensive Nuclear Test Ban Treaty Organization, because volcanic ash is abrasive to the engines of jetliners. Dense ash plumes can be seen and avoided; the real danger comes far downrange of the volcano, where the ash density is too low for the pilot to see the hazard. International aviation authorities are hoping to use infrasound as means of locating eruptions and issuing prompt warnings, Christie says.

Another commercial use of infrasound is for avalanche warnings. Anyone who's ever heard one knows that an avalanche produces not only an audible roar, but a chest-shaking vibration of palpable infrasound.[16] Alfred Bedard, Jr., of the National Oceanic and Atmospheric Administration's Environmental Technology Laboratory in Boulder, Colorado, notes that simple detectors can be placed near known avalanche paths and linked to electronic traffic signs. When an avalanche occurs, the sensors activate the signs to stop motorists at a safe distance. More sensitive detectors, located at greater distances, can count the number of avalanches in an entire mountain range and help avalanche forecasters improve the warnings issued for backcountry skiers.[17]

Bedard is also working with infrasound as a means of fine-tuning tornado warnings, beginning with a pilot project designed to monitor parts of Colorado, Kansas, Nebraska, Oklahoma, and Wyoming with a three-station network. (As with seismology, three infrasound stations are needed to triangulate on the source of a signal.) Tornadoes emit infrasound when the funnel cloud is stretched. This causes it to vibrate radially, at infrasound frequencies. The larger the tornado, the slower is the frequency of vibration. A funnel cloud that's a quarter-mile in diameter (a big tornado) will vibrate at about 1 Hz. Small funnels, too tiny to show up on Doppler radar, vibrate at 5 Hz to 10 Hz. The goal is to track and count tornadoes with greater precision than current methods permit. It may also be possible to use infrasound for earthquake warnings. Bedard reports that a study in Armenia is examining infrasonic waves that appear to be emitted as precursors to earthquakes. These waves propagate outward into the atmosphere, where they affect the ionosphere in ways that can be detected by radar.

Because infrasound involves low frequencies, it takes large-scale events to produce it. This limits infrasound's forensic uses, but doesn't mean that they're nonexistent. Space launches and re-entries can be detected from more than a thousand miles away, and following the explosion of the Space Shuttle Columbia in early 2003, infrasound researchers quickly began poring over their recordings in search of clues to what might have gone wrong.[18]

Other infrasound sources range from the mundane (traffic noise on busy freeways) to the exotic (the Northern Lights). Important human sources include the oil-well fires set by the Iraqi military as it retreated from Kuwait in 1991, sonic booms, and chemical explo-

[16] I experienced this once, climbing in the North Cascades, when a snowfield on an adjacent mountain let go in a slab avalanche that produced a ripping, tearing noise, accompanied by a rumble I could feel from more than a mile away. It was an amazing event, and also the end of the day's climbing, when my friends and I began wondering what other snowfields might lurk above us, out of sight.

[17] In places where skiing and snowshoeing are popular, avalanche conditions are commonly included in weather forecasts.

[18] As of press time, none of this information had been made public.

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sions (e.g., a fire at a fireworks factory). Overall, says Christie, there are at least forty known sources of infrasound, "and we're going to have a lot more."

Pipeline Revisited

So what happened during that pipeline explosion in New Mexico? As luck would have it, two arrays of seismometers had been deployed in the area for short-term geological studies, and more than a dozen of these instruments recorded usable data about the explosion.

Koper's first observation was that the seismic signal lasted for more than an hour. During that time, the fire showed up as an easily noticeable vibration that quit at exactly the time when the pipeline company said the blaze had been extinguished. Nobody had really doubted the company's records, but the attorneys on Koper's side were happy to have independent verification.

The real interest was in the seismic details. These showed several distinct stages in the first minute of the event. Stage one was the pipeline blowout. It appeared in the seismographs as an explosion-style jolt. Stage two was a continuous high-frequency vibration, much weaker than the roaring from the ensuing fire. This, Koper concluded, must have come from gas from the pipeline, scouring the earth as it jetted out of the hole. The fire had not yet started. Then, 24.0 seconds later, there was a second bang, followed by the roar of flames. This, Koper concluded, had to be the explosion that ignited the fire. It was followed, 17.8 seconds later, by a third explosion, probably from the ignition of a pool of gas that had not been ignited by the initial spark. At this point, the roaring stepped up a notch, indicating that the pipeline had been fully converted into a gigantic torch. But the initial scouring signal remained discernable: a high-frequency hiss, masked but not obscured by the louder signal from the conflagration itself.

When the pipeline company finally began to get the fire under control, it didn't shut off all at once. Rather, it diminished in a series of steps, as valves were shut down one by one, reducing the amount of gas feeding the flame. The last of these marked the time when rescue workers were finally able to approach the victims.

All of this proved highly relevant to the ensuing legal settlement. Because some of the victims survived long enough to be transported to the hospital, it is arguable that they might have survived had rescue workers been able to get to them sooner. Some pipelines have automatic shut-off valves that quickly clamp down in the event of a leak. This one did not. The seismometer readings provide independent confirmation of company records indicating that in the absence of valves, it took an hour to shut off the gas.

More important, though, is the 24-second gap between the blowout and the primary ignition. This, Koper says, implied two important things. The first was that the blowout itself didn't supply the spark that ignited the gas. Otherwise, the fire would have started immediately.

Twenty-four seconds is about the length of time it would take a 10 mile-per-hour breeze to waft gas from the pipeline to the campsite. Because of this, Koper suspects that the gas was ignited by something at the campsite—perhaps a campfire, or a Coleman stove. Also, that 24-second delay was important under New Mexico law because the length of time during which people are placed in mortal danger affects the punitive damages their survivors can collect. Twenty-four seconds is a long time to be staring down the barrel of a loaded gun wondering whether the trigger is going to be pulled. But it's not the same thing as a minute, or five minutes. The ability of the seismic readings to quantify this, Koper says, played an important role in the size of the eventual settlement.

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Forensic seismology is a field that is burgeoning so rapidly that it is hard to predict the future. "We're just beginning to eke out every wiggle on the seismogram and what it's telling us," says Wallace. And even though seismometers cost somewhere on the order of $100,000 apiece to install, the number of permanent installations around the globe is only going to increase with each passing decade. "They're always on, and very sensitive," he says, "and it is common for exotic sources to be recorded."

What else these sources might include is up to speculation. Someday soon, one of the new wave of forensically oriented crime shows will stumble onto this technology and base a script around it. All that's needed would be to have the otherwise-perfect crime occur close enough to a seismic station for a key event to be recorded, establishing a timeline that shatters the villain's carefully constructed alibi. "Mr. Jones," the brilliant detective could then say, "we know your car hit that abutment at precisely 10:23 P.M., rather than an hour later, as you told the police. That means you ran off the road fleeing the scene of the crime, rather than driving home later on, after spending the evening with your sister, 50 miles away. You were here, crawling out of the ditch, while your sister was trying to establish your alibi by sitting in a pub with someone who looked like you, charging drinks on your credit card. Sisters lie. Seismometers don't."

Forensic seismology is an arena in which reality and mainstream detective fiction might just beat science fiction to the punch. ■

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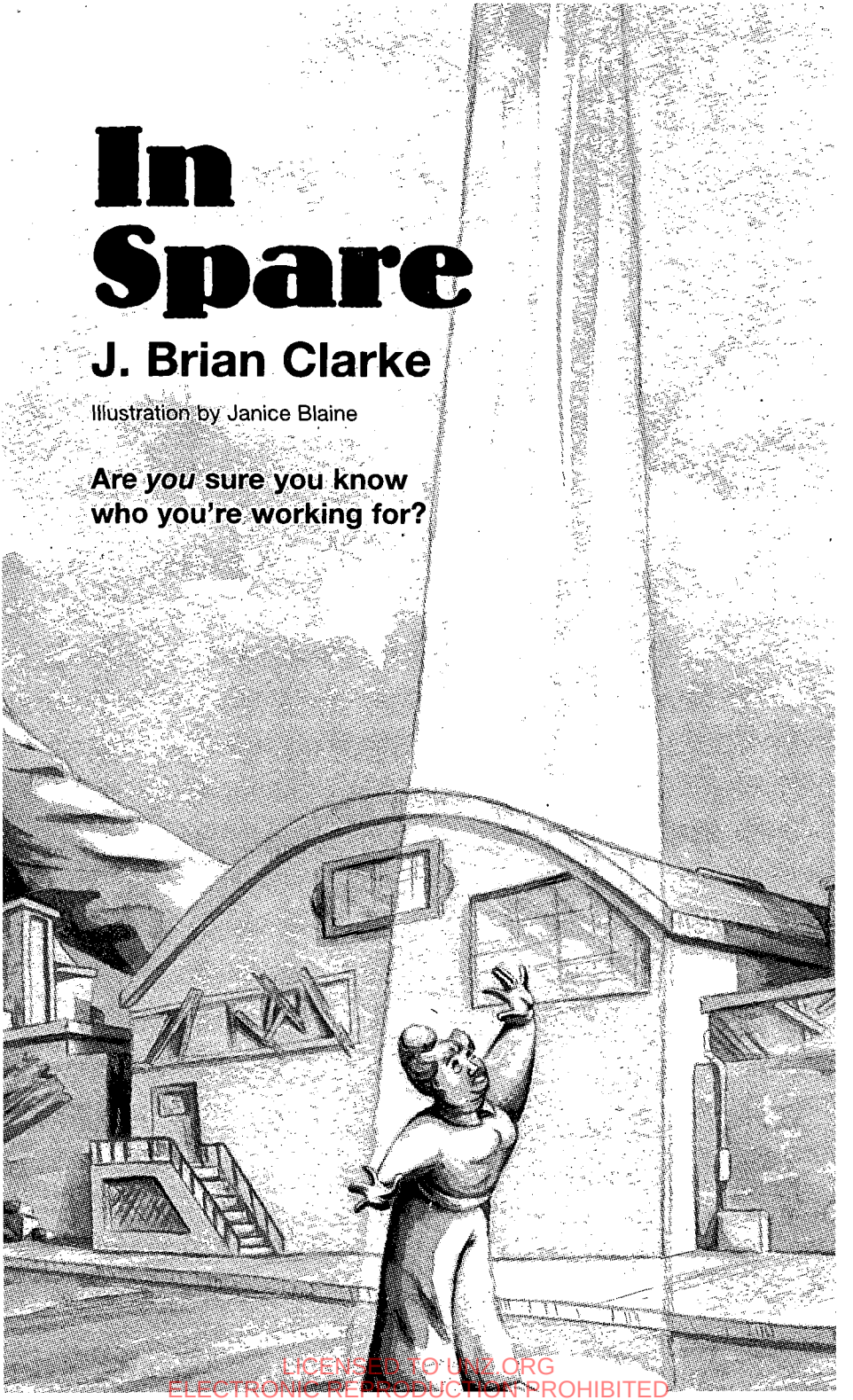
In Spare

J. Brian Clarke

Illustration by Janice Blaine

Are *you* sure you know who you're working for?



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1.

Although Harrison Chuff often visited the Deputy Undersecretary for Extraterrestrial Affairs in her office, this was the first time he had been invited to her east-facing penthouse apartment on the eighty-first floor of the United Nations of Earth tower. For various reasons he felt distinctly uneasy as he stood outside the door and announced himself.

"Ah, Mr. Chuff," the door responded, then added slyly as it slid silently aside, "Please enter my lair."

Chuff, who was a small and rather portly man with not much hair, stepped hesitatingly across the threshold. As the door closed behind him, he found himself in a large, gaudily decorated and furnished living area with a window-wall which overlooked the U.N.E. complex and the ocean beyond. In addition to an enormous couch and several huge chairs, there was a rather ordinary hard chair which looked distinctly out of place.

"You look well, Mr. Chuff dear," Florenzia Higgins' booming contralto informed him as she emerged from an inner room. A huge woman in a blue too-tight pant suit, overdone makeup, and meticulously coiffured white hair towering over her head; to the uninitiated her excellency was overwhelming. To Chuff, who knew her better, she was even more. She gestured at the hard chair. "It is time you and I had a little chat, don't you think?"

Chuff went to the chair and sat down. He tried to appear nonchalant. "Yes, Flo. It is time."

Florenzia lowered her bulk onto one of the large chairs. It must have been specially constructed, because it hardly sagged beneath her weight. "How long have you been with Department Thirty-One?" she inquired.

Suspecting his boss was not merely trying to make conversation, Chuff made a face. "Haven't heard that name for a while."

She waved a hand irritably. "All right, 'ET Sales' if you insist, although I do not approve. How long?"

"A little under eight years." *And you know it!*

"During that time, have I given you reason to doubt my leadership? Indeed, my dedication to the development of Earth's trade with the offworlders?"

"Not at all. It's just that . . ." Chuff hesitated. *Dammit, how do you accuse your boss of being an ET?*

He need not have worried.

"You suspect I am an offworlder myself, don't you dear?" she asked, taking the wind completely out of his sails.

After a moment of incredulous silence, Chuff cleared his throat and asked hoarsely, "How did you, uh. . . ?"

She waved a dismissive hand. "It was not difficult, considering your years of experience dealing with our friends from the stars. In fact, I would say it is practically inevitable you would develop a nose for . . ." Florenzia grinned wickedly and tapped the side of a bulbous nostril. "ETs?"

Chuff took a deep breath and let it out slowly. Now was not the time to lose control. "There is more to it than that."

A heavily marked eyebrow lifted slightly. "Oh, I am quite sure there is. And you are going to tell me, aren't you?"

"Well . . ." Perhaps experience does help, the man thought as he analyzed his feelings and found them not wanting. No panic, not even nervousness. Shifting into the more familiar negotiation mode, he decided on the direct approach. "To start with, Flo, you are too much larger than life."

Both eyebrows rose this time. "I beg your pardon?"

"Let me put it this way. There are occasions when the best way to hide something is to put it in plain view."

"Ah-hah!" Florenzia wagged a fat finger. "In the guise of an overweight, overdressed, and overhaired loudmouth female politician. Is that what you are

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trying to say?"

He avoided her challenging stare, "I wouldn't go quite that far."

"I would. In fact, I just did. Anything else?"

Chuff allowed himself to relax. Until a few minutes ago he had imagined the confrontation would be equivalent to venturing unarmed into a war zone. Now, he was even beginning to enjoy himself. "You had to have had help."

She chuckled. "From little green men, no doubt."

"Well, I admit I did consider the L.G.M. angle. That is, until I realized that the principle 'hide in plain view' need not apply to only one individual."

The chuckle became uproarious laughter. "Mr. Chuff dear, I do believe you found too many fat ladies!"

2.

Whatever else she was, her excellency was an understanding host. She excused herself so he could wander about the big room, stare out of the window and further adjust to a situation which was certainly pregnant with possibilities. When she returned with a glass of Chuff's favorite brand, along with a tray of sandwiches, Chuff was back on his chair. "So the fact you are not . . ." He took a refreshing sip. "what you seem to be, is finally to come into the open?"

"Not exactly," Florenzia said. "Only to you."

"Uh-oh." Chuff felt a chill which was not from the brew. "Before you go any further, Flo, are you sure you don't want Secretary General Halverson in on this?"

"The S.G.?" Again that uproarious laugh. "Although I do respect the dear lady, she is a politician after all. You, Mr. Chuff, are burdened with no such baggage. In any case, you already know part of the truth, don't you?"

"I suspect I do," he admitted cautiously as he attempted to sort out his confused thoughts. "There is much I do not know, of course."

"Of course." His host waved a bejeweled hand. "Ask whatever you want, dear."

The man took a deep swallow and studied the still rising bubbles in his glass. When he looked up, the words came out in a rush. "Who or what are you? Why are you on Earth and how long have you been here? Dammit, how many of you *are* there?"

Florenzia raised both hands in mock protest. "One question at a time, Mr. Chuff. Please!" She became serious. "Do you mind if I answer the last one first?"

It was a direct challenge. Although it was conceivable the number of large females in administrative positions within the U.N.E. was merely a statistical anomaly, Chuff had for too long suspected otherwise. In any case, Florenzia had already confirmed that suspicion. So he decided to play it cool. "It would be a start," he agreed.

"I am alone. There are no others."

He blinked. "Alone? But you said . . ."

"I know what I said, dear. But that was an acknowledgment of fact, not an admission of some kind of alien infiltration." His host chuckled. "Oh, I admit it was not always so. Several of us worked within the system for many years to establish the personae you now know as Florenzia Higgins. My sisters were eventually recalled to other assignments, but not before we scoured U.N.E.'s employee database for replacement ladies who not only matched our physical dimensions, but shared our propensity for . . ." Florenzia grinned. ". . . the garish? Think of the transfers as camouflage, Mr. Chuff. To mask what otherwise might have attracted unwarranted attention."

Chuff took another swallow and put the glass down. He was grateful he had not placed himself in personal jeopardy by accusing an innocent large lady of being an alien. "How long has this been going on?"

Florenzia wagged an admonishing finger, "As I told you, dear. For many years."

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And then some, the man suspected as he considered the planet-wide complexity of documentation and databases which had to have been subverted to create an identity where none existed before. "I presume you have a purpose?"

She shrugged. "Nothing sinister, I assure you. Mostly it has been a process of progressing through the hierarchy, making friends along the way and giving an occasional nudge when and where it is needed. You see Mr. Chuff, despite the physical differences between your species and mine, we are similar in many ways. In short, not only are we alike, we like you!"

"You like us, huh?" Chuff said as he eyed her gargantuan dimensions. He added doubtfully, "As far as physical similarity is concerned, I suppose you are not *that* much different."

She was amused. "Because I am similarly upright and bipedal?"

"Something like that."

"Mr. Chuff, are you prepared for a shock?"

Chuff was a hardened salesman who had negotiated deals with ETs ranging from intelligent blobs to entities who required containment at a thousand atmospheres. So his chuckle was not forced. "Flo, it would take a lot to . . ."

His words failed and eyes widened with disbelief as Florenzia grasped both sides of her head and removed it with a faint *plop*. Careful not to disturb its elaborate coiffure, she placed the head on a table next to her chair. Out of the neck opening squirmed a slender humanoid resembling what might result if a squirrel mated with a chimpanzee, except the brow was lofty, it was hairless and tailless, and its gold-yellow eyes twinkled with humorous intelligence. The creature hopped down to the floor, leaned against the columnar legs of its simulacrum and inquired in a thin, breathless voice, "Well, Mr. Chuff? Are you shocked?"

"Let's just say . . ." The man licked his lips and decided to be diplomatic. "Yes. I guess I am."

He noticed the Florenzia creature did not seem comfortable, and already there was a sheen of dampness on its brown, leathery hide. It panted, "You have one minute, Mr. Chuff, which is as long as I can tolerate this awful heat and humidity!"

He stood up and walked unsteadily to the decapitated thing which for nearly eight years had been his boss. As its former occupant moved considerately aside, he peered into the neck opening and saw only a thick, slowly undulating gray mist.

"You can put your hand inside, dear. Don't worry, it won't bite."

Hesitatingly, Chuff inserted his right hand into the mist. It was cold, like inserting his hand into a refrigerator. He flexed his fingers, and the right hand fingers of the Florenzia simulacrum matched the movement. He made the Florenzia thumb fold over and touch the heavy ring on the middle finger, *and felt the ring as if it was on his own finger*. With a muttered imprecation, he snatched out his hand and backed away.

"Time's up!", exclaimed the creature as it scrambled up the Florenzia body and slithered into the neck opening. The sim's fat arms retrieved the head and lowered it gently into place. Finally, the restored Florenzia let out her breath in a long, contented sigh. "Ah. Much better!"

Try as he might, Chuff could see no join mark on the thick neck.

"You see Mr. Chuff, my species evolved in a cool, dry climate much like the environment of Earth's high mountain plateaus. It is why it is so unpleasant for me to expose myself to the clammy heat you find normal. In my simulacrum however, I am truly the human female you know as Florenzia Higgins."

I have seen worse, the man told himself as he tried to adjust. "Is that why you, er, it, is so big?"

"Please do not think of my simulacrum as an it, Mr. Chuff. When I am in-

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side, it is *me*. As far as size is concerned . . . ." She shrugged. "You cannot design that kind of capability within the limited compass of a normal human body and still have room for an operator."

"What species are you?"

Again an admonishing finger. "Some day when I am in a good mood, it is possible I will tell you. But until that moment of revelation, I choose to remain a generously endowed female politician named Florenzia Higgins, or Flo to my friends and colleagues." She added with a chuckle, "To everyone else of course, I remain 'your excellency.'"

Chuff sighed. He realized if he was going to get answers, he needed to get to the nub. "So what is this about? Why am I here?"

She reached to the side table from which she had just retrieved her head, opened a small drawer and handed over a folded piece of paper. "It was delivered anonymously late yesterday."

"Anonymously?"

"This is a copy, of course. Our crime lab people are still examining the original; paper, ink, the works. So far nothing lethal. Neither were there prints or indication of origin."

He unfolded the paper and read a simple, hand-printed message: I KNOW YOU ARE INSIDE WHAT THEY THINK YOU ARE. MEET ME AT LANGLEY'S CROSSING.

"I looked up Langley's Crossing," Florenzia said. "It's an abandoned general store and service station which served a local rural population before the big dry, and is about twenty minutes by copter from here."

Chuff rubbed his chin. "I suppose 'they' refers to us humans." He looked again at the message. "I would say whoever sent this is either an E.T., or someone pretending to be one."

Florenzia nodded. "I agree. Most troubling of course is the possibility of exposure. If it is revealed the Deputy Undersecretary for External Affairs is a non-human, the political, social and economic repercussions will be . . ." Fat shoulders lifted and subsided. "Drastic."

"To say the least," Chuff agreed. "So what happens now?"

"Well, I presume my movements are being monitored. So if I go . . ."

"Do you think you should? Even if this is simple extortion, I don't advise it. Too risky."

"To my person? I doubt it. But I agree it would be unwise for a woman in my position to go gallivanting alone into the countryside, especially when there is a talented substitute who can go in my place."

He frowned. "There is? Who do you have in mind?"

With a broad grin, Florenzia heaved herself out of her chair and placed a large hand an Chuff's shoulder. "Mr. Chuff dear, this is a situation which requires the talents of Department Thirty-One's most experienced negotiator."

Chuff was startled. "Me? Flo, even if this individual is an E.T., it expects Florenzia Higgins at that place. Not an undersized male salesman!"

Florenzia beckoned and led Chuff to a door at the far side of the room. He followed her into a large storage area stacked with suitcases, boxes and filing cabinets. She opened one of the suitcases and dragged into the middle of the floor what at first appearance was an untidy bundle of plastic sheeting. But when she produced what looked like a TV remote and began punching instructions into it, Chuff realized that bundle was something quite remarkable.

With a noise almost like a human sigh, it shivered, expanded, ran through a gamut of colors and expanded again. For a few seconds the metamorphosis halted as Florenzia turned to Chuff and inquired, "What is your height, dear?"

"One hundred and sixty centimeters," he replied as he nervously watched the slow pulsations of the thing on the floor.

"Weight?"

He swallowed. "Seventy-five kilos or so."

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"Good enough."

Muttering something about "temperature adjustment and access mode," she punched more instructions. The thing shivered, expanded again and finally became a grossly naked twin of Florenzia Higgins lying on its back.

Chuff resisted the temptation to avert his eyes from the ugly mountain of flesh. "Your spare?"

"My spare," his host agreed. "Not the prettiest thing in the world, is it?" She leaned over and did something to the stomach, which split from neck to crotch leaving a long opening filled with an undulating grayness. "Too bad you are a little too large for neck access. Remove your clothes, please."

"Uh . . . I beg your pardon?"

Florenzia grinned. "Modest, Mr. Chuff?"

"Damn right I am! Plus the fact that, that . . ." His face turned red. "Flo, there is no way I will get into that thing!"

"Why not?"

He glared at the supine simulacrum. "*That* is why not!"

She became reasonable. "Think of it in terms of what it really is, which is a sophisticated disguise based on principles my people perfected centuries ago. It fully interfaces with all senses and body functions, to the extent you will hardly know you are wearing it. So give it a spin, if only for a few minutes. You may even change your mind."

He hesitated. "Is this really necessary?"

"No pressure, Mr. Chuff. If you choose to leave now, I will simply ignore the message. Of course, as I have already pointed out . . ."

She did not need to say more. Revelation that a senior member of the U.N.E. hierarchy was an extraterrestrial would be perfect grist for the Earth Union Alliance's xenophobic mill. Fascism still lurked in the darker corners of the human political psyche.

Chuff sighed as he removed his jacket and loosened his tie. "Do I need to take off everything?"

His host politely looked away. "It would be advisable. Even the briefest scrap of cloth might confuse the interface."

Comforting himself with the mental image of the vulnerability he had seen emerge out of Florenzia, Chuff reluctantly stripped down to his chubby, unprepossessing self and shivering, stepped cautiously to the side of the "spare." He lifted his right foot, inserted it into the opening and wriggled his toes.

The sim's right toes obediently wriggled.

"Are you in yet?" Florenzia asked.

"Don't rush me." He took a deep breath, stepped into the mist and lowered himself as if into a bathtub. There was a blissful sensation of a million cool caresses on his skin and then, as he stretched his legs and lowered his head, a sudden intensification of all his senses. It was like stepping out of a cave into the light. "Wow," he said.

Florenzia turned, "Wow indeed," she echoed good-naturedly as she reached down and closed the front of the simulacrum. "You may stand up now, dear."

He stood. Despite the sim's bulk, it was astonishingly easy. Its amplified muscles and senses made him feel he could outperform most athletes.

"Wow," Chuff said again. His voice sounded strange in his ears. Hell, he *felt* strange.

Florenzia nodded. "First you must learn to restrain yourself. You are, after all, an older woman with a weight problem."

And how, he thought uncharitably as he curved the sim's fat lips into a broad smile. "Meaning I am now your excellency?"

"Meaning exactly that. Now please lie down again, and I will unzip you out of there."

Chuff hesitated. "Actually, it isn't that bad. Do you mind if I try it just a little longer?"

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She laughed. "What did I tell you? All right Mr. Chuff, we will go back into the main room and get Florenzia Two dressed and something done with that hair. My gawd, it's a mess!"

3.

Florenzia happened to be a qualified copter pilot. Chuff was not. So after a "leaked" memo revealed her excellency's license was temporarily withdrawn because of an unspecified vision problem, Chuff/Florenzia was flown by one of the department's pilots to the place marked on the map as Langley's Crossing.

During the twenty minute ride, the man within the simulacrum mentally reviewed the astonishing events of the past several hours. Under the relentless tutoring of the original, Chuff had mastered the waddling walk and speech of her excellency to the extent that when he/she marched into Extraterrestrial Affairs and instructed one of the staff to have a copter on the roof pad ASAP, he was obeyed without comment. But when he checked with the original from her private office, she was annoyed. "Don't push it, Mr. Chuff. If someone blunders in there and sees me talking to me . . ."

He grinned at her image on the monitor. "Sorry, Flo, couldn't resist. Anyway, I told your secretary I am not to be disturbed until the copter arrives."

Florenzia was only slightly mollified. "In that case, I will allow this one mistake. Otherwise . . ." Her glare was ferocious.

Hearing a whirring outside, he said hurriedly. "My ride is here. Gotta go."

"Then go!" she snapped, adding as he reached for the off switch, "But keep in mind I am not enthused about being a non-person any longer than I have to be!"

Chuff chuckled to himself at that. For an entity with an ego to match the size of her sim, even a few hours as a "non-person" was probably equivalent to being locked in a closet.

The sound of the copter's electric whine changed as the pilot banked the machine over a shallow valley. "Langley's Crossing, ma'am. Any particular spot?"

Using the sim's enhanced vision, Chuff peered down at a few weather beaten buildings clustered around a faint intersection. He indicated what looked like a large parking area. "Down there will do."

After the copter landed amid its own dust storm, Chuff remembered his lessons and made a show of backing the Florenzia bulk carefully through the door and down the short ladder onto potholed, weedy tarmac. A few meters away were a couple of concrete islands which once boasted half a dozen gasoline pumps, and beyond that the sad remnants of what used to be a general store and service bay plus a couple of ancillary buildings. LANGLEY'S EMPORIUM AND DINER was barely readable on the sign mounted above the sagging veranda of the main building.

"You have your instructions," Chuff shouted to the pilot. "Get this thing out of sight and stay there until you hear from me. Understood?"

"Understood." The man looked concerned. "Ma'am, this place looks awful desolate. If anything happens to you . . ."

Chuff made the simulacrum look cross. "I'll be fine. Now get out of here!" He slid the door shut and hurried from under the copter's whirlwind. He waited until the machine vanished beyond the rim of the valley, then turned and looked around. Langley's Crossing was indeed a lonely place. Other than the weeds, patches of brown grass and a few stunted trees lining a small creek, there was not a living thing in sight. Above, a few clouds floated lethargic in a sun-baked sky.

He wished he had a mirror, so he could look again at him/herself as he did back in Florenzia's penthouse. The "practical" cream-colored pant suit

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which was surprisingly comfortable despite its tight fit, the sensible shoes, the ridiculous net which restrained the hair so it did not pile on top of the head like an exaggerated ice cream cone. Chuff tried not to think of the undergarments he had struggled into with Florenzia's amused help, or of the simulacrum's interfaced plumbing arrangements he vowed he would not use unless he absolutely, absolutely *had* to. At least the sim had its own cooling system. Despite the day's heat, he was quite comfortable.

Suddenly, further up the valley beyond the buildings, he saw a vertical beam of light.

Except for its impossibility against a blue sky in broad daylight, it looked almost like an old fashioned searchlight. It had to be some kind of beacon.

. . . for Florenzia Higgins, no doubt.

4.

The first thing he saw after he woke was the underside of the bunk above him. His head ached, there was a sour taste in his mouth, the bunk was too short, and there was not enough head room. He blinked and tried to organize his thoughts. He had been inside . . .

The simulacrum!

He forced his legs (his hairy Harrison Chuff legs) over the side of the bunk, painfully bumped his head as he did so, then sat hunched forward and rubbed his sore head while he tried to figure out what was going on. He was in a small cabin with barely room for the bunks, a pull-down table and a small chair. A set of gray coveralls hung from a hook on the door, and there was a pair of moccasins on the floor. The air on his naked body was dry and cold, causing Chuff to shiver. So he took down the coveralls and put them on. The stitching was crude, suggesting the garment had been hurriedly made. The moccasins were too small, but stretchable. As he was pulling on the footwear, the door opened and a being came in.

The being looked remarkably like Florenzia *sans* simulacrum, except it was a little bigger in all dimensions and hairier. Clad in coveralls of a bilious fluorescent green, it wore a belt carrying what Chuff assumed was a communicator plus a couple of devices he could not identify. In perfect unaccented English, the being addressed him pleasantly with a voice a little less reedy than Florenzia's. "Glad you are back with us, human. How do you feel?"

Chuff glared. "My name is Chuff. *Mister* Chuff! As far as my feelings are concerned, I feel like I have been kidnapped. What is this place and who the hell are you?"

"You are on board a starship, Mr. Chuff, and you can call me Fred."

"*Fred?*" At first Chuff wanted to laugh, but his anger quickly overwhelmed his sense of humor. "So this is a starship, is it? Where are you from and where are you taking me?"

"Where we are from is immaterial, Mr. Chuff. As far as where we are going is concerned, I assure you we intend to remain in your solar system until our business with you is concluded. Then you will be returned to your world unharmed." Fred hesitated a moment, sniffed and added peevishly, "For us, the delay will be inconvenient. But then again, we did expect another."

Chuff managed the beginning of a grin. "I am sure you did. Anyway, what business?"

Fred seemed surprised. "The simulacrum, of course."

It was Chuff's turn to appear surprised, although in his case it was an act. "The sim, huh? So that is what this is all about." He made a show of looking around the tiny cabin. He even peered under the bunk. "Sorry. It isn't here."

Fred, who presumably was unfamiliar with sarcasm, merely looked baffled. "Of course it is not here, Mr. Chuff. It has been removed for study."

Chuff remained silent as he took a deep breath and stirred his brain into ac-

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tion. Memory crowded in, of the sim effortlessly negotiating the rough terrain of the valley as he headed toward the beacon, occasionally leaping over the creek, dodging around and sometimes over boulders, maintaining a pace any cross-country runner would envy. Yet whatever took him out was so sudden, it allowed no time for even the briefest realization. One moment he was effortlessly trotting toward the mysterious beam, the next he was nursing a headache on board a starship he presumed had no legitimate business in the solar system.

Fred said patiently, "I am sure you have questions, Mr. Chuff."

Oh, do I have questions! But the man knew he had to be careful. "I suspect you know the main ones already," he responded cautiously.

"Indeed I do," Fred said with a strangled snort Chuff presumed was a chuckle. "For instance, it is not coincidence I resemble the one you know as Florenzia. We share a common ancestry, which diverged when my ancestors emigrated to a neighboring solar system many generations ago. Unfortunately, although habitable, my planet is less benign than the home world. So centuries of having to deal with its extreme climate and aggressive life forms have made us bigger than our cousins, stronger, and . . ." Fred displayed two rows of wicked looking teeth. ". . . more competitive."

"More competitive, huh?" Chuff tried to match Fred's leer. "So what your cousins have that you don't have, you want. Is that how it goes?"

Fred was not offended. "Not generally, Mr. Chuff. Only when we learned of our cousins' involvement with your relatively primitive world did it occur to our leaders this was an unprecedented opportunity. Earth is the last place they would expect us to seek one of their secrets, and indeed our acquisition of the simulacrum proves we were right. Its various technologies will advance my world by many decades."

"Do Florenzia's people know of you?"

"Of course. We are regarded much as a fond parent might regard her wayward children. In matters such as food production, health, transportation, the arts and so on, we are helped and encouraged. Otherwise, we are discouraged from acquiring anything they consider . . . dangerous."

"So the sim is on the proscribed list?"

"Very high on the list."

"All right, you have got yourselves one slightly used but intact simulacrum. So send me back home and be on your way."

"Be patient, Mr. Chuff. Meanwhile, you have full run of the ship." Fred nodded politely, turned and left the cabin. Noticeably, he did not close the door.

After a moment, Chuff peered out into a deserted corridor.

Full run of the ship, huh?

Is that a legitimate invitation, or am I a rat being persuaded into a maze?

"So I play it by ear," the man muttered to himself as he entered the corridor and turned right toward a door with a transparent panel and an illuminated pictograph of what looked like a test tube across a magnifying glass. He padded to the door and peered through the panel. Beneath an array of lights, several of the aliens were clustered around a low platform on which lay the mountain of flesh which was the Florenzia simulacrum. Two of the aliens were clad in the bilious green, the others in an equally hideous yellow. The neck-to-crotch aperture of the simulacrum was open, and one of the yellows was in the process of removing his (her?) garment.

Chuff's eyes widened as he studied the naked being. Although he/she/it was superficially much like the Florenzia creature, its arms, legs, and most of its head down to the shoulders were covered with coarse, gray-black hair. In contrast, the torso, hands and feet were hairless, making the nakedness seem almost obscene. A faint horizontal crease

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across where in a human the navel would be, was perhaps a hint of some kind of retracted sexual apparatus.

Or perhaps it was just a crease.

The naked alien ascended the platform and, as Chuff had once done, gingerly inserted a foot into the sim's gray-swirled opening.

For a moment, nothing. Then a cry of agony as, his foot bright red as if exposed to live steam, the alien staggered back into the arms of one of his companions. Still moaning with pain, he was hustled out through a door at the far side of the room.

Score one for the good guys, Chuff thought smugly as he pushed open the door and entered the room. "I see you have problems." He did not even attempt to hide his satisfaction.

One of the two greens turned toward him. Although there were no distinguishing features, Chuff made himself a bet it was Fred. "A most astute observation, Mr. Chuff. Would you like to venture a suggestion?"

Chuff did so, with graphic detail.

Fred looked puzzled. "Not only is such a contortion anatomically impossible, I do not understand what it has to do with our current dilemma."

Chuff sighed. "What makes you think I can help you, anyway?"

"The fact you were in the simulacrum. Surely, that suggests you have at least some basic knowledge of its systems. Or perhaps we should look elsewhere?"

Chuff suspected it would be imprudent to betray his ignorance, so he sidestepped the question. "Go ahead. Look anywhere you damn well please!"

Fred raised both hands in dismay. "Please Mr. Chuff, no slight is intended. Indeed, although the one you know as Florenzia obviously preferred not to respond to our invitation in person, I doubt she would allow the simulacrum's use by any human except one she knows and trusts. So tell me, Mr. Chuff. Is my logic at fault?"

Chuff continued to sidestep. "You seem pretty sure Florenzia is a female."

A sideways tilt of the head. *A shrug?* "It is a female name, is it not? In any case, with a ratio of nineteen females to each male on her native planet, it is not such a difficult assumption."

"Oh," said Chuff, realizing he had just learned something he did not know before. Does that mean Fred is also a female? Yet so as not to further complicate matters in his mind, he decided to stay with the status quo and assume Fred was a male. "So what do you need me for?"

"Will you help us, Mr. Chuff?"

"Help you? Why should I?"

"Why not?"

Chuff had the feeling this conversation was getting exactly nowhere. "Because," he retorted acidly, "where I come from, it is considered bad form for kidnap victims to help their kidnappers."

"You cannot be persuaded?"

Chuff said nothing.

"I see." After a brief hesitation, Fred added regretfully. "So we must use means other than simple persuasion?"

Chuff was tempted to laugh. A threat voiced as a question somehow did not have the effect he suspected it was supposed to have. Nevertheless, he decided to play it straight. "What do you have in mind?"

"Nothing barbaric, I assure you."

Which is nice to know, the man thought with relief, although he suspected this bunch lacked the stomach for what "barbaric" implied. But his relief was short-lived as a quartet of yellows abruptly grabbed him by the arms, dragged him to the simulacrum and thrust his left hand into the swirling grayness of the stomach opening.

As Chuff struggled, his fingers opening and clenching, the fingers of the simulacrum's left hand similarly opened and clenched. Finally his captors slackened their hold and allowed him to stand free.

"Well," said Fred as he studied an in-

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strument panel. "*Well.*"

"Well what?" Chuff grumped as he pulled down the rumpled sleeves of his coverall.

"Would you do that again, please?" If it had been "pretty please" Chuff would not have been surprised. Fred's plea sounded like a child negotiating for a second candy.

Not sure why he agreed to the request, but rationalizing that if he refused they would probably force him to anyway, the man again inserted his hand into the grayness. This time he added a derogatory one-finger insult. He was amused as the sim did the same. Too bad the gesture was wasted on these people, although . . .

Stall!

It was a soundless admonition which roared in his head like a thunderclap.

Stall!

Chuff had enough presence of mind to barely blink, even as the mental imperative repeated a third time:

Stall!

His hand trembled and Fred's indicators reacted as within his mind Chuff framed and projected a response.

Flo?

No answer, although he sensed something at the edge of his awareness.

Florenzia?

Still no answer, although there remained that tantalizing hint of something. Some*one*.

Although Chuff's face remained impassive, his thoughts were in turmoil. If it was Florenzia, did "stall" mean what it implied, that she needed time? How much time? Minutes? Hours? And for what? Was some dramatic development in the works, or was this merely a trick of his captors?

He wagged the finger again and watched lights dance on Fred's instrument panel.

"Fascinating," Fred commented. "An absolute correspondence; two organisms behaving as one."

Despite the turmoil in his head, Chuff decided he should say something. "What's so fascinating? Surely you have mechanical waldos which do the same thing."

"Of course we do, Mr. Chuff. But a waldo is merely a mechanical tool. This is . . ." Again the sideways tilt of the head. ". . . superior."

Chuff suspected the aliens were as unaccustomed to superlatives as they were to sarcasm. "I am glad you think so."

"Is it possible you might. . . ?" Fred even managed to look apologetic.

"You want me to get inside the sim, don't you?"

"Is it really such an imposition, Mr. Chuff? If with your help we obtain the data we need, we may not need the simulacrum to reproduce our own version. Then we will gladly return you and the simulacrum to your planet and be on our way. We will be light years away before we can apply the knowledge in any practical form, so our gain will hardly be your world's loss."

"It isn't my world's to lose," Chuff muttered half to himself, not caring if Fred heard him or not. In any case, he doubted his captors could build their own sim just from data they might gain, even if he did climb aboard and have the sim perform like a trained seal.

Which meant Fred was lying.

Which also meant the simulacrum would not be returned to Earth, and probably not its human operator either.

So whether or not he re-entered the sim would not affect Chuff's future, at least as far as Fred and his cohorts were concerned. But if that really was Flo who communicated through the sim when he inserted his hand, then obviously there was more to that supine pile of synthetic flesh than she had told him.

Perhaps there was even a concealed weapon!

Suddenly Chuff could not wait to climb back into the simulacrum. But he held his eagerness in check as he said with feigned reluctance, "All right, I will do it. But only because of your promise

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to return me to Earth when the tests are done."

"Of course, Mr. Chuff. The simulacrum also."

"I will believe that when it happens," the man retorted, hoping an apparent partial surrender would dampen any suspicions of duplicity. He pulled off the moccasins, shrugged off the coverall and, shivering, stepped onto the platform alongside the sim. He inserted his foot into the opening and wriggled his toes.

The simulacrum's toes did the same.

"All of you, please Mr. Chuff," Fred said patiently as he watched his instruments. The others also watched, although their attention was focused on the naked, pudgy human.

Chuff was aware of the fascination and sensed their revulsion. He blew them a kiss. "Take a good look guys, girls, or whatever. If I have anything to say about it, this is the only time you will feast your eyes on my unadorned charms!"

Then he stepped into the sim and lay down.

5.

Again the sensations he remembered; the cool caresses on his skin; the intense awareness of his surroundings. Through his enhanced vision he watched Fred close the front of the simulacrum (if they had learned to do that, what would they have done with the remote if they had it?) and turn back to his instrument panel.

"Please stand," Fred asked.

Chuff/Florenzia bounded to his feet. In the ship's simulated 0.9 Earth gravity, it was ridiculously easy.

The instruments danced.

"Very good, Mr. Chuff." Fred handed him a metal bar about a meter long. "It is just ordinary steel. Show me what you can do with it."

Chuff bent the bar into a tight loop. It took some effort, enough that the sim protested by allowing his human heart to race and forcing him to take several deep breaths into his human lungs.

Don't do that again!

Chuff had to restrain a gasp. *Flo?*

A soundless chuckle. *The same, dear. Can you keep your friends interested for a few more minutes, this time without unduly stressing my precious second self?*

It's only your spare!

As far as you are concerned, Mr. Chuff, it is Florenzia Higgins you are abusing, not a soulless contrivance.

Of course, Flo, of course. Chuff was so relieved, he had to stop himself babbling. *What do you have in mind? What is going to happen?*

Just keep them distracted until I get back to you. Do you think you can do that? Oh, and by the way there is no weapon. Sorry about that.

Damn! Wondering if Flo read his mind, but hoping she had merely made an assumption, Chuff realized he held the still warm, looped steel bar. He dropped it to the floor, where it hit the metal plates with a clang.

Fred looked disappointed. "I was about to ask you to straighten it, Mr. Chuff."

Chuff used his/the sim's foot to push the bar aside. "Not this time. There are limits, you know."

"Ah." Fred did not seem disappointed. He went to the door and opened it. "Please run to the end of the corridor and back."

The corridor was about forty meters long with a heavy steel hatch at the far end. Chuff did as he was asked, plus a couple of embellishments. He ran, bounced feet first off the hatch, did a complete flip, landed on his feet again, and ran back to his starting point. Unlike with the metal bar, the sim did not object. Chuff found himself breathing as easily as if he had only indulged in a short stroll.

Fred and his colleagues clapped their approval. It was a polite alien clapping, palms to back of hands. "Well done, Mr.

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Chuff. Now just a few more tests, and we will be finished for now."

After recognizing assorted geometric shapes from the other side of the room, the smallest only a few millimeters across, and then being asked to identify sounds made by a range of small objects dropped from various heights onto various surfaces, Chuff started to wonder how much longer he would have to perform before things began to happen.

His eyes wandered upward to where a conduit bundle extended across the room, wall to wall. Otherwise tucked neatly against the ceiling, the bundle was offset around a support column leaving a graspable few centimeters on either side of the column. Wondering how critical those conduits were, and if he dared again apply the sim's maximum strength, Chuff flexed the fingers of both hands.

Keep them distracted, Flo said. But she also told him in no uncertain terms not to abuse the sim. For the briefest moment, Chuff considered his options.

What options?, he wondered even as he decided he really didn't have any. Then; *Flo, I hope you still like me after this!*

With a sudden bound, Chuff reached for and grasped the bundle on either side of the column, swung the sim's feet forward to brace against the wall, and *pulled* . . .

He barely heard the squeaking shouts of alarmed aliens as the bundle at first resisted and then, very slightly, began to move away from the wall. There was a groan of brackets distorting and then being pulled free. The sim, which obviously did not like what he was doing, allowed enough stress through to Chuff's own body that his heart raced, vision blurred, and his muscles felt they would tear from the strain. But he persisted, even as the lights flickered and went out, and there was a deafening shriek of a siren.

Gasping, he finally let go, fell heavily on something soft, then rolled over and crawled hurriedly in the dark toward what he hoped was the door. As he crawled, he thought he heard a disapproving *Mr. Chuff!* just before the sim suddenly constricted and then began to crumple around him. Within seconds, the ultra-sophistication of the Florenzia simulacrum degenerated into something resembling a claustrophobic covering of layers of rotting plastic. Chuff tried to draw breath and momentarily panicked as something plugged his mouth and nostrils. He gasped, struggled, thrashed his arms and legs and suddenly found himself free, naked, and lying face down on cold metal plating. He scrabbled around for what remained of the sim, and found only a piece which turned to coarse, gritty powder in his hand.

Dim emergency lighting came on. The siren was still wailing, although to Chuff's human ears it was not nearly as deafening as it had seemed to the sim. A group of aliens at the far side of the room were jabbering at each other and throwing switches. Another knelt next to the prone body of a yellow-clad . . .

That's what broke my fall—I fell on the bastard! Realizing how unpopular he must be at that moment, Chuff glanced desperately around and saw the door less than a meter away. Somehow he opened it and squirmed into the corridor without being noticed.

As he reached up to quietly close the door behind him, the emergency lights went out. The siren continued.

Now what?

It was utter, claustrophobic blackness. Only the ship's artificial gravity, apparently unaffected by his act of sabotage, indicated the vertical. Shouts from behind the door, faintly audible above the siren's racket, gave him a vague sense of direction. Chuff stumbled to his feet, felt for the wall and groped his way toward what he hoped was the room in which he had woken after his abduction. He needed a huddling place until rescue came.

If it ever comes!

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Chuff started to shiver, and then found he could not stop shivering. He was as naked and defenseless as a human being can be, in an environment as chilly as a winter's night.

Momentarily wondering why his captors weren't coming after him with portable lamps, Chuff supposed they were too involved trying to return systems back on line. But that preoccupation would not last, especially after they got the lights working. As he continued his groping progress along the corridor, he glanced back, expecting to see flashes of illumination through the laboratory door's glass panel as his captors struggled to repair the damage.

Not even a glimmer. It was more than just the absence of light, it was as if he was in a stygian universe where photons never existed. The corridor seemed endless, with his fingers sensing only a seamless metal wall. Door, door, where is my door? *God, what do I do now?*

Chuff was not particularly religious. Yet as if the deity heard his anguished plea for help, the man suddenly found himself surrounded with whispering presences, and a small hand slipped into his and tugged him along the corridor. Not particularly caring what happened to him now, Chuff allowed himself to be tugged. The whispering intensified as other small hands pushed his head down and guided him over a threshold into some kind of tunnel which flexed and swayed as he staggered along. Then across another threshold and back onto a firm floor. Again there was room to stand.

Chuff was exhausted. He desperately wanted to sleep, even if it was on his feet. If he allowed his eyes to close, what difference would it make anyway in this awful dark? As he started to sag into blissful unconsciousness, he dimly sensed himself being lifted and carried along by those diminutive hands. The whispering faded. But just before he slumped completely into oblivion, he thought he heard again that voice. This time it was not so disapproving.

Well done, dear!

6.

He stretched luxuriously. The warm sunshine felt good on his bare skin.

Startled, Chuff blinked and sat upright. He was in the valley again, next to the tiny creek. A few hundred meters down the valley he could just see the ramshackle structures once known as Langley's Crossing. It was still warm, but instead of a few puffy clouds, the sky was piled with white cumulus.

How long since he was last here? He felt the stubble on his chin. A day? Two? Had his kidnappers fed him? He could not remember. He thought longingly of a steak accompanied by hash browns and a mug of steaming hot coffee, and decided they had not.

Of more immediate concern was the fact he was stark naked. No clothes and, equally as embarrassing, no communicator. A couple of meters away, a ground squirrel watched him warily. It was perched on a suitcase.

A suitcase. Clothes! As Chuff scrambled to his feet, the squirrel squeaked and dove for cover up a nearby tree. The suitcase was ordinary, medium-sized and not particularly new. Chuff was about to open it, when he was interrupted by a thin, reedy little voice.

"Not yet, Mr. Chuff dear. Not yet!"

Startled, he swung around to face the owner of the voice and its wagging finger. "What. . . ?"

It was the Florenzia creature. A transparent substance completely covered her, except for a compact life support unit tucked between the diminutive shoulders.

Noting the small, delicate hands, and remembering the tug of small hands in the darkness of his captors' ship, Chuff knew now who had rescued him. He squeezed his eyes shut, looked again. "Flo?"

She pirouetted. "Like my space suit, dear? Bit more compact than my late

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lamented simulacrum, don't you think?" She grinned at him. "Yet compared to you, I am overdressed!"

He looked down and tried inadequately to cover himself. "I . . . ah . . ."

"Please do not concern yourself, Mr. Chuff. After all, to my alien eyes you are somewhat less than . . ." The grin grew impossibly wider. ". . . desirable."

Chuff restrained himself from further incoherence. Instead he took a deep breath and kept his mouth shut.

The being nodded approvingly. "I suppose you would like an explanation."

He let out his breath. "It would be a good idea," he said, wishing for at least a towel. He cast a longing eye at the suitcase.

"It was my sisters who extricated you from your unfortunate predicament and dropped you off here."

Chuff reluctantly turned his attention from the suitcase. "I realize that now. How did they get to me so fast?"

"We have had our own ship in the solar system since we first came to your world."

Somehow he was not surprised. "The asteroid belt?"

She nodded. "The perfect hiding place. I notified my sisters as soon as I knew you were in trouble, although I suspect they had already responded to an alarm from the simulacrum. Its bellow became even louder when you pulled off that silly stunt which destroyed a very valuable item of equipment."

"Silly? Flo, what else could I have done? And who was it who later told me 'well done'?"

"Oh, that was me," the Florenzia creature admitted unashamedly. "Nevertheless, considering what you so cruelly extinguished . . ."

Chuff made a strangled noise. "If I'd have known your precious property was worth more to you than . . . than . . ."

She chuckled. "You are getting red all over, do you know that? Never mind, I suppose you cannot be blamed. Although what you hoped to accomplish, I cannot imagine."

"How can you possibly say that? When I pulled those conduits from the wall, the whole ship went dark! Didn't your, ah, sisters tell you?"

"Sorry to disillusion you dear, but that was pure coincidence. Although you may have disrupted a few non-essential circuits, the emergency lights worked just fine, thank you."

"But . . ."

"Eyes, Mr. Chuff. Eyes. The neurology of sight is actually astonishingly similar in most species, didn't you know that? At the moment you were doing your best to dismantle everything, my sisters directed a finely tuned energy pulse at the ship of our miscreant cousins and temporarily blinded everyone on board. You, your captors—even pests such as the equivalent of insects and rodents—were rendered completely sightless. As I said, it was only a temporary effect. But it lasted long enough for a boarding party to gain access to the ship and get you off it. After such an experience, I do not doubt your friends are getting themselves as far away as possible, as fast as possible."

"What will your people do to them?"

"Such as spanking them, imposing sanctions, etcetera, etcetera? Earthly things like that?"

"Earthly things like that," Chuff echoed ungraciously, suspecting he was about to get a lesson in political morality.

If there was a lesson, it turned out to be very brief. "We will do nothing," Florenzia said, "that has not already been done."

Obviously a people who learn from their mistakes. Chuff was about to concede lesson learned, when he changed his mind and sat down on the suitcase. He anticipated Florenzia would admonish him for his choice of a resting place, indeed hoped for it. She might even finally allow him to open it and grab some

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clothes. Considering his inner turmoil of gratitude mixed with confusion, and the feeling he had been thoroughly made a fool of, he would in any event be satisfied to get her rattled even slightly. He made a show of shifting his weight, crossed his legs and asked as he pointedly patted the side of the suitcase, "Now, may I please get dressed?"

Florenzia studied her tiny hands. The gesture was astonishingly similar to a woman studying her fingernails as a delaying tactic, and had the same effect. With a sinking feeling he was about to hear unwelcome news, the man asked again, "Clothes? Please?"

She said, "I have been recalled for debriefing and a little R and R. I will be away about a month."

To say Chuff was relieved would be an understatement. He had expected something much worse, such as she had forgotten to bring his clothes. "So you need me to mind the store while you are gone. Is that a problem?"

"Not at all, dear. I know Department Thirty-One will be in good hands." The small being resumed the study of her hands.

Again Chuff had that sinking feeling. "There is more?"

"Think about it, Mr. Chuff. Florenzia Higgins simply cannot disappear for several weeks without attracting considerable and unwelcome comment."

Chuff did think about it. It took about five seconds, after which he jumped off the suitcase as if it was red hot and glared at it. "Oh, no. Not again!"

"I will return with a fresh spare, of course. Meanwhile, I have adjusted this unit to accommodate you, Mr. Chuff." At the touch of a small hand, the suitcase popped open and the thing with the big hair expanded out of its confines with a whooshing sigh like a fat lady stepping out of her girdle. Chuff also glimpsed a folded scarlet pant suit, shoes, and necessary unmentionables.

He thought he would choke.

Florenzia continued, "I have arranged for a selection of your own garments to be waiting for you in my penthouse. It is an arrangement which ensures that while I am away, the comings and goings of Florenzia Higgins and Department Thirty-One's senior negotiator will be interpreted as business as usual."

"Please no," Chuff pleaded weakly.

"In about three hours from now, after the shuttle which dropped you off has returned for me, a copter will arrive to transport Florenzia Higgins back to the U.N.E. tower. It leaves little enough time to prepare."

Trying to accustom himself to the fact that this was a situation in which he had no choice except to accept the inevitable, Chuff sought comfort with the memory of himself as Florenzia being accepted without question by the staff at Extraterrestrial Affairs. He supposed he could spend a few hours a week within the Florenzia simulacrum, in her office, without too much difficulty. It might even be fun.

He sighed. "Excuse me for asking, but prepare for what?"

To his increasing dismay, Florenzia began ticking off on her small fingers. "First is my speech before the Women's League for Democratic Action. Second, an interview on the *This Is My Day* morning show, followed by lunch with the Russian ambassador. Third, an appointment with the Secretary General. Fourth, a scheduled tour of . . ." She stopped, looked at him closely. "Mr. Chuff, are you alright?"

Harrison Chuff drew in a deep breath and let it out with a long, shuddering sigh. "Oh, I'm just fine," he lied unhappily. ■

[EDITOR'S NOTE: Harrison Chuff and Florenzia Higgins appeared earlier in "Wet," March 2001.]

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Dibs

Brian Plante

Some problems and principles seem much simpler in the abstract than in concrete cases. . . .

It starts with an e-mail at the office. The message arrives in my in-box with a beep and a pop-up window to tell me I have new mail. I voice-command the computer to display the message. The e-mail says I am two-thirds dead.

The message is an automatic notice from the NTRS, the National Tissue Registry Service—my employer. It's a government job, so the pay isn't the greatest, but the benefits are okay. The e-mail looks just like any of the other auto-alarms I get during the course of a day, telling me that we are spiking on memory on the Prod-124 box, or there's a bad parameter holding up some tests on the QA-16 machine. But this e-mail is not an alarm to fix some ailing computer system, it is a message of a more personal nature:

Dear David Danila,

This message is to inform you that you have been identified as a suitable organ donor. A terminally ill patient requires your liver and gall bladder.

So someone's got dibs on my liver. The e-mail goes on with the usual boilerplate text about how important it is for everyone to cooperate, so that critical body parts will be available for everyone when we need them. It's no big deal—dibs come and they go. It wouldn't normally be anything to worry about, except that late last week someone already took dibs on my heart.

I've never had two dibs against me at the same time before. Usually, you get a notice like this saying someone needed your lungs or kidneys, and then a week or so later you get another notice saying the previous e-mail you received "has been rescinded; thank you for participating in the NTRS." It could mean that the sick person got the needed organ from another donor, or it could mean he died waiting. Either way, you don't really want to know. And the bit about thanking you for participating was pure bull—membership in the NTRS data-

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base is compulsory. Something like this only works if *everybody* belongs.

It is a neat system in theory: everybody gets typed and entered into the database, so when you need an organ to stay alive, a donor can easily be found. "The greatest good for the greatest number," is the motto of the NTRS, but it's not exactly true—there's a bit of a fudge-factor built in. When you have two dibs against you, you're still safe, but when *three* sick people can be saved by using your vital organs, the surgeons come for you and take you apart.

I'm still digesting the implications of having two dibs against me when Alberto, my cubicle-neighbor, walks into my space and asks if he can borrow one of my technical reference manuals. Usually I'm very protective—borrowed manuals don't always come back, and my boss often balks at the high replacement cost—but I'm in a daze and unlock my overhead cabinet without thinking. Alberto thumbs through my reference shelf, finds what he's looking for, and exits with a "thanks-a-bunch!" I might never see that book again, but it is the least of my worries now.

Two people have dibs on my organs. First my heart and now my liver. Two people who will probably die, unless I die first. Or unless I am *compelled* to die first, at the hands of some merciless surgeon who will slice me up and dole out my parts. The greatest good for the greatest number. One more dib against me and I'm gone. If somebody comes along needing lungs or kidneys, even though I have two each of those, they'll come and harvest the lot. Even bowels and skin count as capital dibs if some victim needs them to live.

I am only thirty years old. Thirty years and already sitting on death's door. At this very instant, some surgeon could be speaking my death order into his computer, and another e-mail will pop up on my screen. It would be one thing if I were old and sick and looking for donors to replace my own failing organs, but here I am young and healthy, with many more years before the NTRS can do me any good. It just isn't fair.

I want to know who these two people are who would claim my organs and doom me to the death that is rightly theirs. One with a bum ticker, probably a fat old bastard who clogged his arteries with too many cheese fries, and the other with liver failure, no doubt from years of drinking himself into oblivion. A fat bastard and a drunken bum against *me*, a hard-working regular Joe. *The greatest good,* my eye.

There must be something I can do. After all, I work for the department that maintains the NTRS database. If I can just get past security, a couple of simple commands can erase the two dibs I have against me. Let the poor bastards find some other warm body to rob.

I leave my cubicle and walk into my supervisor's office. Jordan Marinos is sitting at her desk, watching statistics scroll on her computer screen. I like Jordan a lot—she works hard and is usually fair with her underlings. She's not half bad looking either, although it would probably be a stupid idea for me to ask her out for anything other than a business occasion. She sees me out of the corner of her eye and looks up.

"Jeez, Dave, you look like you've seen a ghost," she says. "Are you okay?"

"Yeah," I answer. "Jordan, I need a temporary emergency logon ID for the production database."

"I haven't received any alarms," she says, her face showing concern. "What's the emergency?"

"It's not really a critical issue," I say. "I want to try correlating some tissue types by family name and ethnicity. My read-only ID doesn't include those fields in the database view. I'm just checking up on an idea I have."

It is a bald-faced lie. I want the emergency ID so I can go in and alter my database record to remove the two dibs against me. Jordan looks away for a moment, thinking it over, then comes back

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with, "I don't know, Dave. I think it's a good idea that you want to explore new patterns in the data, but the auditors will want a bit more justification. Write it up as a formal request and I'll submit it to management."

Jordan has integrity. Damn it. Integrity is not what I need right now. Under the circumstances, integrity goes right out the window. I need to save my ass before a third dib comes along.

For the rest of the afternoon and long into the night, I formulate a plan.

The next day, after the usual morning health checks to make sure all the systems are running smoothly, I start running some database queries. It is difficult finding out what I need to know, as my regular ID is restricted. I cannot retrieve names and addresses in my database view, nor search on individual dibs.

What I *can* do is piece together some useful information with a series of related queries. I voice-command the database to retrieve all the potential donors within my zip code who have dibs against both their hearts and livers. This brings up a single unique result, which I know must be my own record, although any information identifying the record as mine is hidden from my view. What I can see is the 1024-digit code that identifies my complete tissue type. The number is gobbledygook to view, but it codes to many critical genetic factors that indicate how close a match one person's organs are to another.

Next, I command the database to retrieve all waiting recipients with the identical tissue type. The database responds immediately that there are no exact matches. I am apparently unique. That's bad news, as it means that the two bastards who have dibs on me aren't likely to have any multiple dibs on some other poor sap like me. I am probably their only hope.

The long tissue type code is made up of many factors such as the person's age or eye color that may not influence the tissue-matching algorithms much. I command the database to retrieve all the waiting recipients for hearts and livers that differ from my tissue code by a single digit. Again, there are no matches.

I instruct the database to retrieve all heart and liver recipients that differ from my code by five or fewer digits, and only two records are returned. One is a heart recipient, and the other a liver. I am reasonably sure I have found the two dibs against me.

The database does not reveal to my read-only ID the names of the two people who need my organs. I see their long tissue codes, which look the same as mine, although I know there must be a few digits different if I examine every single character. There are some other long numbers for these two records, and I know these are medical diagnosis codes that indicate their failing health status and critical need for organ transplants. Their names, addresses, phone numbers, places of employment, physician name, and hospital are all blocked out.

All I have to go on are the zip codes for the two potential recipients.

I bring up the Post Office website on my screen and look up the two zip codes. The heart patient is from Smyrna, Delaware. The liver patient is in Carbondale, Pennsylvania.

Next, I search for the hospitals nearest to the two zip codes. The two people with dibs against me are almost certainly hospitalized. Fortunately, these are small towns with only one main hospital each.

I telephone the hospital in Smyrna and ask for the Intensive Care Unit. When a nurse picks up, I explain to her that I work for the NTRS and that we may have a match for their heart patient. The nurse is a bit hesitant and I fear she may not want to give out confidential information on the phone, but I hear other voices and the sound of machines beeping in the background. The ICU is busy and the nurse quickly confirms

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that they indeed have a patient waiting for a heart transplant. I ask for the patient's name and the nurse tells me. Kirby Steise is the name of the bastard who has dibs on my heart.

I repeat the process with the Carbondale hospital and learn that Sam Borysko is the name of the person who has dibs on my liver.

Kirby Steise and Sam Borysko. Good old Kirby and Sam, down on their luck and waiting for poor Dave Danila to drop dead and bail them out with some much-needed chunks of meat. Well, we'll see about that.

Kirby and Sam are out of luck, as far as I am concerned. They're half-dead already, and I'm still young and healthy. I am not going to just sit around waiting for a third person to claim a dib on me and have the doctors come to take me away. Kirby and Sam are as good as dead— it wouldn't really be like murder if I just help one of them along.

I call in sick the next day and take a ride out to Smyrna, Delaware, to visit Kirby Steise. Fat old Kirby, with his hardened arteries and failing heart. Selfish old Kirby who wants to be young again by cutting the very life out of my chest.

At the hospital reception desk, I ask for good old Kirby's room number. The ICU is on the third floor, but only immediate family members are allowed to visit. I hang around the lobby a few minutes and take note of what the hospital staff is wearing.

Around the block from the hospital is a large pharmacy and surgical supply store. They do a lot of business with the hospital, so they stock a selection of smocks and surgical scrubs and I buy one that looks like what I saw the hospital staff wearing, and the cheapest stethoscope they have in stock.

Instead of entering the hospital through the main lobby, I drive around to the back and find another entrance where the employees come and go on their way to lunch. Dressed in my new smock, with my stethoscope draped over my neck, I wait for a pair of nurses to open the door and slip in unnoticed with them. I spot a clipboard hanging from a cleaning cart and grab it, to complete my disguise. No one notices me wandering down the hallway with my smock, stethoscope, and clipboard, and I eventually find the elevator to the third floor ICU.

It is lunchtime and there is only one nurse in the station guarding the entrance to the ICU. I loiter in the corridor, pretending to be studying my clipboard, until she is called away by some beeping machinery. I stride confidently down the hallway toward good old Kirby Steise's room.

I have not given much thought to how I will actually handle old Kirby. I suppose I might simply smother him with a pillow, since he is apt to be too weak to fight back. I could unplug his monitors or shut down his heart-lung machine. Maybe I could slip something into his IV line.

I reach the doorway and enter. There is only one bed in the room. But instead of fat old Kirby, the bed is occupied by a slender woman, perhaps a few years older than I. She is asleep, but several machines alongside the bed beep and pump fluids and spit out paper tape with spiky tracings on them.

I examine the medical chart at the foot of the bed. Most of it does not make any sense to me, but I gather that this woman *is* Kirby Steise. What kind of stupid name is Kirby for a woman, I wonder? She is thirty-two years old, not totally unattractive, and not at all what I had pictured in my mind. Hastening her death might not be as simple a task as I had imagined.

"Looks pretty grim, huh?" she says, surprising me. Flustered, I put the chart back on the hook at the foot of the bed.

"Um, well, I see you have dibs on a donor," I say.

"Yeah, but only a single match turned up," she replies. "Now if that damned

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donor would only be kind enough to get hit by a bus, I'll be back on my feet in no time."

"Or get two more dibs against him," I tell her.

"Oh sure, like that's going to happen."

"It happens all the time," I say. "The greatest good for the greatest number, and all that."

"It doesn't happen all that often," she says. "Are you the new surgeon?"

"Um, no," I say. I am not prepared to speak to her, and I make something up on the spot. "I'm just a researcher. Doing, um, research. I hope you don't mind."

"Nah, I'm used to it by now. So what are you researching?"

Think fast. "I'm trying to correlate the causes of heart disease with lifestyle factors."

"Like what?"

"I'm not sure yet. Eating habits, sleep, work, family life, that sort of thing."

She pauses and stares at me like I'm an idiot.

"For the last three months, I've eaten nothing but hospital food," she says. "The drugs you guys give me make me sleep most of the day. Work? Not lately. Family, yeah, when they visit. Not what you'd call family life, though."

"I mean before you . . . got sick," I say. "Are you married?"

"Yeah. Stephen is his name. He's been really great about my getting sick."

"Kids?"

"One. Harry. This is probably tougher on him than it is on me. He's only seven."

"And what did you . . . what do you do for a living?"

"I'm an art restorer. Cleaning and retouching old paintings."

I smile. "Bringing damaged works back to life?"

"Yeah, something like that." She looks at me again like I'm an idiot and says, "The other doctors have all said what I have is a genetic defect, not my lifestyle. How could any of this be important to your research?"

"Sometimes you just never know," I say.

The next day I am in Carbondale, Pennsylvania. Before driving out there, I log onto the NTRS database from home and repeat my queries, adding the "gender" field to the result set, and confirm that Sam Borysko is indeed a male, and not just a Samantha masquerading as a Sam. Good old Sam. Hard-drinking Sam. Fast-living, life-of-the-party, cirrhosis-of-the-liver Sam, dying from too many nights of tequila shots or vodka martinis.

I still have the two dibs against me, but maybe I can pull the plug on drunken Sam, who doesn't really deserve my healthy, unpolluted liver, easier than I could do something to that nice woman, Kirby. I use the same procedure as before to sneak into to the ICU. I'm getting good at this.

Sam Borysko is male, all right. He is a young boy, maybe eleven or twelve years old. His skin and the whites of his eyes are yellow with jaundice.

"Hello," Sam says when I enter the room. "You're new. If you're here to take blood, could you use the right arm this time? I think the vein's collapsing on my left one."

"I'm not taking blood," I say. "I just need to ask you some questions. You're Sam, right?"

"Yes, sir."

"Well, your chart here says you have hepatitis. Do you know how you got that disease?"

"The other doctors said it was probably from something I ate."

"How are you feeling, Sam?"

"It's not so bad," the boy says. "I'm tired all the time and I feel like I'm going to throw up, but it doesn't really hurt so much."

Where does a kid like this, laid up in the hospital, dying with a failing liver, get such a positive attitude? If it were me in his place, I know I'd be miserable.

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"Do you go to school?" I ask him.

"Well, I used to. I'm supposed to start middle school this year, if I. . . ."

The boy's voice trails off, and I guess the unsaid words are *if I live*. He is dying and surely knows it, but doesn't want to say it.

"How is your family holding up?" I ask.

"My mom cries a lot," the boy replies. "My dad flew out to see me when I first got sick, and he still calls almost every day. I talk to him a lot more now than when he was still living with us. Mom's new husband is okay, too, I guess, but he's not my real dad. He's a good guy and my mom likes him a lot."

"Do you have any brothers or sisters?"

"I have a little sister, Lucy, but she doesn't come to the hospital much. Mom says she just doesn't understand about stuff like this. I hope I can get better so she won't be so sad any more."

"I hope so, too," I say.

The boy does not complain. He does not cry. His primary concern is that his little sister not be sad. Such strength for a child.

"Am I going to die?" the boy asks.

"Not if I can help it," I reply.

Back at the office, I tell my boss Jordan, "I have two dibs against me—heart and liver."

"Oh no," she gasps, and I hear genuine concern in her voice. She's very nice. If I survive this, I may yet work up the courage to ask her out socially.

"It's okay," I tell her. "If a third one comes along, I'm ready to do my duty."

Jordan looks at me like I'm crazy.

"In fact, I was wondering about something," I say. "If there were, like, two people who really needed my organs, and they were going to die if they didn't get them soon, wouldn't it be a good thing to, um, let the doctors come and take what they needed now rather than wait for a third dib to come along and be too late?"

Jordan's mouth drops open.

"It's the greatest good for the greatest number, right?" I say.

Jordan is aghast. "It's *three* dibs, David. And that's highly unlikely. Don't rush it, okay? You're sounding a bit unreasonable."

"I'm trying to be logical about how things should work."

"This is not logic, David. This is just nuts. I think you need to take the rest of the week off and get your head together. Relax and take it easy. See a shrink if the pressure is too much. This will all blow over in a few days, like most dibs do."

She means when they die. When Kirby and Sam are dead. And I am still alive.

I stay at home the rest of the week, watching my computer screen, waiting for the e-mail to tell me I can save a third sick person. I realize I must have frightened Jordan into thinking I might be suicidal, and I field several unsolicited calls from a company psychologist. I would never kill myself, I explain honestly. I am just waiting for another needy person to match up with my tissue type and claim his dibs. I am ready to go.

Take it away—heart, liver, kidneys, skin, eyes, lungs, stomach, guts, blood vessels, bone marrow—whatever you need. Who am I to live when folks like Kirby and Sam are dying? It's just the luck of the draw. The greatest good for the greatest number.

A box pops up on the computer on Friday morning. It is a message from the NTRS:

Dear David Danila,

This message is to inform you that a notice you received recently about a terminally ill patient concerning your liver and gall bladder has been rescinded. Thank you for your continued participation in the NTRS program.

It is the kid, Sam Borysko. There is little chance another exact match could have been found and the liver become available so quickly. Unselfish Sam. Never-complaining Sam. Not-worried-for-himself Sam. I am sorry that his little sis-

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ter will be so sad.

I retrieve the local newspage for Carbondale on the Net and find Sam's obituary is already online.

I attend the boy's wake on Saturday afternoon. The mother, father, step-father, and the little sister, Lucy, are all grief-stricken. He looks so peaceful in the small coffin, and I realize his jaundiced skin must be concealed by a layer of natural-looking makeup. It is too much for me to bear and I begin sobbing, a tear splashing onto the boy's fine jacket and tie as I lean over his body.

One of the men approaches me and hands me a tissue. Is he the father or the step-father, I wonder? But it does not matter which.

"Were you one of Sam's teachers?" the man asks me.

I dab at another tear rolling down my cheek with the tissue.

"No," I reply. "He was one of mine."■

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EDWARD TELLER, R.I.P.

This column I mourn the passing of a personal icon, Edward Teller, known by most as the "father of the hydrogen bomb," an appellation he disliked, not out of shame, but because he felt it gave him excessive credit. Shortly after his role in the development of the H-bomb became public knowledge, he wrote a piece called "The Work of Many People" to set the record straight. Though it appeared in *Science* in 1955, the label stuck for the remaining five decades of his life. Teller died on September 9, 2003, at the age of 95. I was nearly finished reading his autobiography *Memoirs* (1) when I heard of his death.

Obituaries of Dr. Teller describe him as a controversial figure. In addition to his hydrogen bomb work, he was also a strong proponent of building defenses against ballistic missiles (BMD, SDI, or "star wars" to some). And many in the physics community, due to his testimony at the hearing, blamed Teller for the revocation of the security clearance of J. Robert Oppenheimer.

That Teller was, in fact, a controversial figure is impossible to deny. That he did, in fact, *do* anything that genuinely warranted the controversy he inspires, I strongly dispute. Indeed, history has shown that, in the matters in which his memory is impugned, Teller was on the right side, and his detractors, many of them the so-called "academic elite," on the wrong side.

The development of the atomic bomb was an unparalleled achievement, made possible by the concentration of brilliance assembled at Los Alamos. As most people know, in 1939 Albert Einstein sent a letter to President Franklin Roosevelt detailing the possibility of making an atomic bomb. But Einstein didn't write the letter. It was written by Leo Szilárd, and he and Teller (Teller had to drive—Szilárd, genius that he was, never mastered the art) went to see Einstein, the most famous physicist since Isaac Newton, to sign it. So Teller was as "there at the beginning" of the nuclear age as it was possible to be.

Work on the atomic bomb began several years before the laboratory at Los Alamos was finished, but by March of 1943 it was possible for Teller and the other geniuses of the Los Alamos group to gather there. Their scientific and intellectual peer, J. Robert Oppenheimer, managed the lab. Though a scientist of exceptional managerial skill, Oppenheimer also had an exceptionally complex personality, not to mention a past that intersected significantly with communism. At the time, however, this was not unusual amongst American intellectuals.

Little needs to be said about the atomic bomb, and what happened during the war, and the bombing of Japan. What is interesting to note for our purposes is that Teller actually spent much of his time at Los Alamos puzzling over the possibility of making a hydrogen bomb. With the war over, many of the scientists who worked on the atomic bomb felt guilty about it afterwards, to greater

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or lesser degrees. Others left the work convinced that they had done what needed to be done and the future was now up to the politicians. But almost all of them shared the feeling that they just wanted to get back to their academic work, and Teller did, too.

But such was not to be.

Immediately after the war, some—Oppenheimer included—thought that the work at Los Alamos was finished and that the lab should be shut down. But it didn't take long before it was clear that it was in the national interest to continue to investigate the potentials of nuclear weapons, and so the lab would continue, albeit without most of the talent that had been assembled for the Manhattan Project. Teller was offered the chance to stay on at Los Alamos, but he was dismayed by the apparent lack of interest (one might even say *hostile* interest) in pursuing work to determine if it was possible to build a hydrogen bomb.

We must be clear on this point. Figuring out whether or not it is possible to build a hydrogen bomb is not the same as *wanting* to build hydrogen bombs. For the sake of national security, Teller wanted the United States to find out, *and to be the first to find out*, whether or not the so-called "super bomb" was feasible. (Teller was not one to prefer wishful thinking over genuine knowledge.) One of the reasons Teller felt this way while so many others in the A-bomb genius circle did not is because Teller had personal experience back in Hungary with just how heavy-handed communism could be. He also had a number of Soviet scientist friends from before the war, so he knew how capable they were of both building atomic bombs of their own and going further to build hydrogen bombs, if it could be done.

As is well known, the Soviets had a weasel in the Los Alamos hen house, he being the spy Klaus Fuchs. The information he conveyed to the Soviet Union proved very helpful to them in building atomic bombs of their own, though Teller never doubted that they could have done so on their own even without Fuchs, once they knew the bomb existed.

After the war, most of the scientists and intelligence people in the United States were convinced that the Soviets would not have a nuclear bomb until the 1960s. So, when they tested one in the fall of 1949, a more realistic attitude toward the Soviets needed to be adopted. Teller became a very vocal and capable spokesman for the side that wanted the United States to begin a vigorous program to develop thermonuclear weapons. Eventually, President Truman gave the go ahead to work on hydrogen bombs, and it is because of Teller's public role in bringing this about that he became known as the father of the hydrogen bomb.

One curious fact about the development of the hydrogen bomb: Teller's earliest conception of how one could perhaps be built turned out to be flawed. Indeed, the best computers of the era calculated that his design wouldn't work, but just barely. Computers and nuclear knowledge of the day being what they were, this was not enough to say it *couldn't* work, though many scientists wished this were so. Once work on the hydrogen bomb began again in earnest, Teller caught his mistake, and it turned out that making hydrogen bombs was much easier than anyone had thought. Indeed, within months of the first successful American hydrogen bomb test, the Soviet Union tested theirs.

Had it not been for Teller, the Soviet Union would have beaten the United States to thermonuclear weapons, and it's not at all unlikely that we might now all be speaking Russian if they had.

During this same period of time, Teller had also grown disillusioned with the mind-set at Los Alamos. He felt that many of the scientists there were too

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convinced of their own infallibility, so he advocated the founding of a second weapons laboratory, to offer friendly competition. This led to the establishment of what is now called the Lawrence Livermore National Laboratory. It also led to the Los Alamos physicists and their friends throughout the country getting their noses out of joint and having a collective, asinine hissy-fit (physicists being no less prone to this sort of immaturity than any other group).

Despite the twin real successes of getting a robust thermonuclear program under way and establishing a second dedicated weapons lab, that one thing that most blighted Teller in the eyes of the physics community was his testimony at the Oppenheimer security clearance hearing.

Volumes have been written about this hearing, and it is outside the range of this essay for me to rehash it, let alone pass judgment upon it. I don't know whether or not Oppenheimer should have lost his clearances. Teller did not think he should have—at least, not based on any hard evidence he himself had.

The fact is, someone was out to get Oppenheimer, just as many other former communists were coming under intense scrutiny in those days. Teller had nothing to do with the hearing even coming about, but when asked to testify, he agreed. Granted, his testimony was less than an endorsement. Teller didn't understand Oppenheimer. Shortly after testifying as follows, ". . . I have always assumed, and I now assume that (Oppenheimer) is loyal to the United States. I believe this, and I shall believe it until I see very conclusive proof to the opposite."—Teller went on to say—"I thoroughly disagreed with him in numerous issues, and his actions, frankly, appeared to me confused and complicated. To this extent, I feel that I would like to see the vital interests of this country in hands which I understand better and therefore trust more." (2)

That's as damning as Teller's testimony got.

Nonetheless, much of the physics community acted as if Oppenheimer's subsequent loss of clearance was the *result* of Teller's testimony. This seems unusually naïve. It was politics! Nothing Teller might have said instead about Oppenheimer, no matter how glowing, would have made a dime's worth of difference to his fate.

Teller remained on the outs with the mainstream physics community for the rest of his life. Many of his old friends stuck by him—Von Neumann, Wigner, and Ernest Lawrence. Even Enrico Fermi, who strongly disagreed with many of Teller's views in the post-war world, sought to heal the rift. But most in the physics community decided to remain assholes about it.

The last thing Teller did that continually irritated his detractors was his championing of a defense against ballistic missiles. His philosophy of "better a shield than a sword," and his tireless advocacy, often against vitriolic opposition, of what to me is the only sane position to take on missile defense, more than anything else made Teller one of my personal heroes.

Strangely, the academic sort of physicist, and even some who work or who have worked on nuclear weapons, deplore ballistic missile defenses. I don't know why they feel this way. It's almost as if they think that the history of weapons design should have stopped with nuclear bombs and missile delivery systems.

At first, Teller advocated pop-up defenses. Under this scenario, an attacker launches his missiles, and the defender launches his anti-missiles once he sees what's coming. Teller wanted to build x-ray laser weapons, powered by small nuclear explosives, that could take out a hundred missiles at once. He did not want to rely on orbiting battle stations since he felt these would be vulnerable

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to preemptive attack.

But as time went on, the SDI program eventually produced Brilliant Pebbles. These were kinetic kill weapons that would have stayed in orbit until needed to destroy attacking missiles. Teller finally backed this sort of system because the Pebbles could be made so small that they would be nearly impossible to find, let alone attack. The important point for me about Teller's change of tune is that he was even able to sing a new song. His anti-ABM detractors, on the other hand, haven't been able to update their own arguments in thirty years.

We could still build Brilliant Pebbles. For a tiny fraction of what we're currently spending in Iraq, we wouldn't have to worry about missiles bearing weapons of mass destruction for at least the rest of my lifetime.

Teller was a great physicist, and a great man, who did great work during one of the most tumultuous times in history. His work helped to end two wars—WWII and the Cold War—and to prevent a third world war. Our timeline is a better place for having had him in it. ■

1. *Memoirs* by Edward Teller. Persus Publishing, 2001. ISBN 0-7382-0532-X
2. *Ibid.* pp. 382-383

IN TIMES TO COME

Back in 1955, this magazine (then called *Astounding Science Fiction*) published a story by James Gunn called "New Blood," about a blood donor whose contribution rejuvenated the recipient, effectively conferring immortality—that is, as long as he or she received periodic "boosters," since the effect was temporary. The special donor was thus very much in demand, which is not entirely an enviable situation. The idea, as Jim Gunn puts it, took on a life of its own, leading to the novel *The Immortals*, a made-for-TV movie, and a television series called *The Immortal*. The visual-media versions, as often happens, had a rather tenuous connection with the original, but the novel survived through several reprintings and translations into at least five languages. Pocket Books will soon be bringing out a new edition, updated by the author and incorporating new material telling a previously untold side of the story: that of the doctor trying to determine what makes the special blood work. Next month we're pleased to offer that new side of the story as an independent novelette, "Elixir."

Our fact article comes from an author new to these pages, K. J. Zimring, and could be viewed as a distant relative of Gunn's novelette, dealing as it does with "The Future of Transplantation." We'll also have a variety of other stories by such authors as Richard A. Lovett, Suzette Haden Elgin, G. David Nordley, and Jerry Oltion. And, of course, the conclusion of Joe Haldeman's *Camouflage*.

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The LIBERATORS

Scott William Carter

Illustration by Nicholas Jainschigg

The answer to "Who—or what—can you trust?" is even more complicated than it used to be!

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I heard the report of a cannon a half second before the boulder on the ridge above us exploded.

Pebbles pinged off my helmet. The ventilator fans whirred behind my ears, and a bead of sweat trickled down my cheek. The suits did a good job of filtering the air, but the inside of my helmet still smelled slightly metallic.

It was the dead of night, but my visosuit enhanced the image, giving the rocky gully an amber tint. The Dulnari had lousy night vision, so we always fought after sunset. I quickly counted ten black, sleek-domed helmets in the gully. Each helmet was marked with a different number, and Rina's number 22 was on the far end. We broke up two weeks earlier, but I still liked having her close during combat.

"Major Steed," my brother's voice crackled over the all-suit frequency, "report."

Damon sounded calm as a man could be. I watched Rina for a reaction, but she didn't move. I knew she had been spending her time lately with that egghead, Lieutenant Dyle, but I still wondered if she and Damon would hook up now that I was out of the picture.

"Got a group of two hundred Dulnari pinned in a mountain bunker, Colonel," I said to him. "The rest of the target planet has been contained."

I stopped thinking of the planets as having names long ago. After a while, they all blurred together.

"Good. We need to finish this planet up and move on to the next one. Get it done quickly."

"Yes, sir."

He cut the transmission.

I suddenly felt tired. There was always another target. Such was the way of life in the elite LS-37, a liberation squad who had liberated more planets from the tyrannical rule of the Dulnari than anyone else. We were legendary in the Unity Defense, our slogan whispered among lesser soldiers like a hallowed prayer. *LS-37, Angels Protected by the Glory of Heaven.*

I peered over the edge of the gully. The mountain sloped up gently until it reached the rectangular peak. An opening big enough for their cannons circled the peak; there were two or three cannons on each side. We could fly up there in under three seconds.

The problem was that we'd be easy targets. What we needed was a distraction.

Our suits were controlled by the electrical impulses in our brains. I *thought* the all-suit frequency on, and it was. "Lieutenant Dyle," I said, "take Delta Group and do a flyby over the mountain, dropping flash grenades. The rest of us will storm the bunker. Hold for my command."

There was a brief pause, and then his reply came back.

"Yes, sir," he said.

"All other teams, await my command," I said.

Before I even finished the sentence, Rina was scooting in my direction. She was a small woman, but inside the bulky black visosuit you would never know it.

Our suits were mini-spacecraft in their own right. The slim packs on our backs were loaded with various bombs and missiles, and the fingers of our gloves were equipped with lasers. The metaplak material could withstand a direct hit from almost any handheld weapon.

Since the Defense had equipped us with the suits, our battles lately had been decisively won. We moved in fast, destroyed the Dulnari's local military, and left just as quickly. A recovery team followed within a day, helping the planet rebuild.

When Rina was close, I could see through the tinted faceplate to her face—or not really her face, but a re-creation of her face on the external screen. She was Asian-Latino by heritage. She had narrow, slanted eyes, and her skin was the color of coffee with cream. The dust in the air made it hard to read her expression.

"Sir," she said, and I could tell she was

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fighting to keep her voice calm. "Sir, could I suggest that we all attack as one? There's no need to put Delta Group in danger."

I wondered how close she and Dyle had truly become. "We need a distraction, Private," I replied.

"But, sir, if we *all* attack—"

"End of discussion," I said curtly.

She glared at me through the dust, then scooted back to the end of the line. The rest of the faceplates were turned toward me. I knew my history with Rina was no secret.

I switched to the all-suit frequency. "Delta Group, attack now!"

My own suit had something my soldiers' suits didn't—a small monitor, mounted inside my helmet just below my faceplate, that allowed me to see what any of my soldiers saw. I thought the command *Screen Forty* and up came Lieutenant Dyle's view.

Dyle was directly over the mountain. The enemy's cannons fired, one after another in rapid succession, and the ground beneath us trembled.

I turned on the all-suit frequency. "All other groups, attack now!"

We took to the air just as white flashes began to spot the mountain. There were five teams, each with ten drop-soldiers, so the sky was filled with fifty of us. I felt the antigrav thrusters trembling beneath my feet.

We descended on their bunker like a swarm of black hornets. All around us were flashes of white light. I followed my men through the opening, blasting the Dulnari standing there with my finger lasers.

We stepped over the bodies we just brought down. They were humanoid, much like us: similar height, two arms and two legs, breathing air and expelling carbon dioxide. One of the most amazing discoveries since contact was made with other species was that these facts held for most of us.

But the Dulnari had a more pronounced, wolf-like nose, and their sense of smell was keener. Their leathery skin was dark gray except for the skin around their yellow eyes, which was a luminescent blue. Their heads were smaller, and individually, they were not as smart. But they had more specialization in intelligence; when they acted in concert, their total intelligence exceeded ours.

The big difference, though, was that the Dulnari were ruthlessly ambitious in a way we never were. Every sentient species we encountered had the *option* of joining the Unity Worlds. The Dulnari took them all by force.

Until we decided to stop them.

A dimly-lit tunnel circled the bunker. We took out each cannon-room one at a time. It all seemed to be going well until Lieutenant Dyle shouted out over the radio.

"Hit! . . . going down!"

Rina stared at me. Grimacing, I changed to Dyle's screen, and saw the image of the ground rushing up at him. My screen went to static, then the image returned. Now he was looking at the sky.

"Must do this . . ." he groaned.

Then the worst possible thing happened.

He removed his helmet.

I knew this because I was suddenly seeing *his* face, bloodied and bruised, on my screen. His blond hair was matted against his scalp. The helmet must have been down on the ground next to him.

"Lieutenant Dyle!" I cried.

It was no use. Without his helmet, communication was impossible. As every drop-soldier knew, the one thing that you could not do—that you were strictly *forbidden* to do—was to remove your helmet. Even if a planet had a breathable atmosphere, the helmet gave a soldier full access to the visosuit's abilities, allowed him to remain in contact with other soldiers, and permitted his superiors to use his visuals for tactical decisions.

I was deciding what to do when my brother bellowed over the frequency.

"Just what the hell is going on down

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there, Major?"

"Sir," I replied, "Lieutenant Dyle's helmet—"

"I can see what happened. What I want to know is why."

"I don't know. Perhaps—"

"The med will be there in less than two minutes," he said. "Let it get him out of there. Subdue the bunker."

"Sir, don't you think we should provide cover for the med?"

"No time. The Dulnari are fleeing the bunker as we speak. Concentrate your troops on stopping them."

He clicked off. The rest of the troops had moved ahead, and it was just me and Rina lagging behind.

"Let's go," I said, stepping past her.

She didn't move.

"Rina? You heard the orders."

"Kaden needs us," she said.

"The med—"

"I'm going."

She ran back into the last cannon-room. I followed, yelling her name, but she didn't stop. She took to the air, rocketing through the opening.

If she died out there, I would hate myself forever. Knowing I was risking a court-martial, I followed her through the opening.

Her foot thrusters were a yellow spot ahead. A cannon boomed. A second later, the projectile glanced off my arm. It didn't puncture my suit, but it sent me crashing into the rocks.

I lay there on the ground, gasping until I got my wind back.

When I took to the air again, I came upon Rina almost immediately. She was in the gully where we were before, exchanging fire with some Dulnari up the slope. Between them was Lieutenant Dyle. His blond hair among all that gray rock stood out like a flame.

He was running toward Rina.

"Major Steed!" my brother shouted inside my helmet. "What the hell are you doing?"

Before I could do anything, a Dulnari got Dyle in the leg. He crumpled to the dirt. One shot could take him out.

Rina must have known this, because she took to the air again. Her blue lasers sent rock and dirt flying.

"Rina!" I cried. I forgot to turn on the radio, so it was only me that heard it.

I swooped down, firing wildly at the enemy. We should have died. But whether it was due to luck or our crazy behavior, we managed to take out all the Dulnari in the area.

We were circling back to Dyle when the med's egg-shaped pod whooshed out of the sky. The shimmering surface of the pod mimicked the landscape behind it, so it was difficult to see unless you knew it was there.

Rina and I pulled up, watching as the base of the pod popped open and a grasping arm descended. It was only on the ground a second, and then up it went, Lieutenant Dyle in its grasp.

When the pod was gone, I noticed that the cannons were quiet. The battle was over.

After returning to the *Stag*, I showered, squeezed in a quick meal, and reported to my brother's quarters.

Our ship was small, with narrow halls and low ceilings. When we were on our way to another target, as we were then, you could feel the metal gangplanks trembling beneath your rubber soles.

Temperatures varied throughout the *Stag* due to the ship's poor ventilation system. Standing in front of my brother's door, I felt cold, and shivered.

I punched the intercom. "Major Steed here," I said.

"Enter," he said.

He was sitting behind his mahogany writing desk, typing into his computer. The room was dark except for the yellow glow from his tiny desk lamp.

Though he was a year older than me, many people mistakenly thought we were twins. We both had long, thin faces, auburn hair, and big noses that looked as if they had been carved out of granite.

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"Go ahead," he said, continuing to look at his monitor.

I told him that I was trying to protect one of my troops who had made a bad decision, and that I thought my troops in the bunker had everything under control. When I was done, he nodded, but still didn't look at me.

"I should have you court-martialed for what you did today," he said.

He said it the way most men would ask for butter for their toast. It was rare these days to get a rise out of him, although it hadn't always been that way.

When we joined the Defense two years earlier, his hatred of the Dulnari ran so deep that he spoke of little else. He had learned it from our father, who had been in the Defense his entire life. Damon had waited a year so he and I could go in together. I thought we were inseparable—the Unstoppable Steeds, as we called ourselves. Then, at training camp, we had the misfortune to fall in love with same woman.

Rina Pullman lost both parents and three brothers to the war. Damon courted her relentlessly, as he did everything, but she told me later that he was too intense. With me, she said she could be at ease, and that my relentless optimism that we would win the war made her believe, too.

After Damon lost Rina, I tried to make amends, but then we got word our father's ship was destroyed. I tried to be there for him, but he ignored me and threw himself into his studies. It paid off. He was tapped for command of a drop-ship.

I did well, too, making major. Rina was never one to study, so she ended up a drop-soldier. After our ship was destroyed, we ended up reassigned to the *Stag* under Damon's command. It was unusual for two brothers to serve together, and I was told it was only until another drop-ship needed me, but six months later, I was still waiting.

"Could I say a few things in my defense, sir?" I asked.

He looked at me. His flinty eyes were completely unreadable. "I'm *not* going to court-martial you," he said. "I merely said I *should*. You disobeyed a direct order from your commanding officer. The violation must still be noted in your file."

I gritted my teeth. Any such note in my file would make it hard to get promoted.

"I understand, sir." And then, after a pause, I added, "And Rina?"

There was a flicker of anger in his eyes, before it was replaced by his usual stone-cold gaze. "Private Pullman is not your concern." He must have sensed he was in the wrong, because he added, "Since she has been a valued soldier, I will assume this is a momentary lapse in judgment. Due to the circumstances with Lieutenant Dyle, I decided not to note this in her log."

I realized something had happened. "Circumstances with Lieutenant Dyle?"

"That was the other matter I needed to speak to you about," he said. "A covert nex-link was discovered in Lieutenant Dyle's quarters. It appears he was in contact with the Resistance."

I was stunned. I never liked Dyle, because he was always debating the political intricacies of the war—how who was right all depended on your point of view, or how the interstellar corporations really controlled everything. It seemed phony. The Dulnari were the enemy, and that's all any soldier needed to know. But despite my dislike for him, I never thought of him as a Resistance sympathizer.

The Resistance was made up of soldiers who had defected to form a terrorist movement opposed to the Defense. They had a few ships, a few thousand soldiers, and a lot of hidden operatives. As far as the Defense was concerned, anyone caught aiding the Resistance was a traitor.

And in the Defense, there was only one way to deal with traitors.

"Private Kaden Dyle, you are hereby found guilty of collaborating with known

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terrorists, a treasonous offense, and by Unity Defense regulations are hereby sentenced to immediate execution."

The med, its deep voice resonating throughout the mess hall, put down the paper and looked at the blond man bound and gagged in front of him. In truth, the med had no need to read the paper, because it was a robot with perfect memory and real-time access to the Unity grid. But the med was always trying to appear more human so people would be more likely to trust it.

Not that it ever worked. It was hard to think of a seven-foot tall, silver-skinned, hairless machine as trustworthy, even if it looked vaguely human. If it only acted as a medical robot, that would be one thing, but its dual role as disciplinarian didn't help. Most soldiers derisively referred to them as *plugs* because of their occasional need to plug into a power source.

Dyle's face was dotted with perspiration. Such a baby face. I had forgotten that he was barely eighteen—and then I had to remind myself that I was only twenty.

"Private Dyle," the med went on, "you are not permitted to speak, for fear that your lies will contaminate your more loyal shipmates. But if you would like to show that you regret your treason, you may now salute your commanding officers."

The med untied Dyle's arm. The room still smelled like the awful meatloaf we had for dinner. Nearly all seventy-five crew members were present. The lights everywhere but at the front had been dimmed, so the crew members were just shadowy heads to me. But I could see Rina. She was near the front, and her brown cheeks were glistening.

There had been five executions for treason in the last four months, and men much older than Kyle had broken down and sobbed. To his credit, he did no such thing.

He didn't salute me or my brother either.

Instead, he turned to his shipmates and saluted *them*.

There was a moment of stunned silence, then two troopers quickly bound his hands. The med stepped forward, its feet clanging against the metal floor. It raised its right hand so it was level with Dyle's shoulder.

"Permission to carry out the execution, Colonel Steed," the med said.

"Permission granted," my brother said. Hell, not even a pause. The man showed less emotion than the med.

A hypodermic needle jutted out of the med's index finger and penetrated Dyle's skin. He let out a muffled cry. His eyelids closed and his head slumped to his chest.

The med put a slender finger on Kaden's neck.

"Well?" my brother said.

"Private Kaden Dyle determined to be dead, sir," the med said.

"Very well. Take him to the morgue."

With that, my brother dismissed us. The soldiers, subdued, shuffled out, and I went with them. Rina was keeping to herself, walking slower than the others.

I saw her turn into the fitness room, and I ducked in after her, feeling my body sag. Normal ship gravity was one-half Earth's, but the fitness room was three times that. We were the only people inside. Rina was already at the punching bag in the corner, and she smacked it with a good roundhouse.

"Nice one," I said. I didn't mean for it to sound patronizing.

She glared at me. Her hair was as black as obsidian, even blacker than the uniform which hugged the curves of her petite figure. When I first saw her in training camp, she took my breath away.

It was still hard for me to understand why we broke up. In the beginning, we were all about having fun, playing virtual hockey, watching holovids, or sharing a pizza, and that was fine by her. But once we were on our drop-ship, she began to read—history, philosophy, anything she could get her hands on. When she broke up with me, she said she wanted some-

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body who would challenge her to think deeper, and she knew I never would.

"What do you want?" she demanded.

"Hey, easy, Pair-o-Deuces, I just thought you might want to talk."

It was an old nickname, and it usually got me a smile. No such luck this time. She laid into the bag with her left. "About what?"

"About Kaden. I knew you were becoming friends."

She snorted. "We weren't sleeping together, if that's what you're worried about."

"No, I wasn't . . ." I began, feeling my anger flaring. So she wasn't in the mood for reconciliation. Fine. "Look, I just wanted to say I'm sorry. I understand why you went to help him on the planet. Not too long ago, you might have done the same for me."

I headed briskly for the door. She pounded the bag with a series of vicious punches, but when I was about to open the door, stopped.

"Vince," she said.

I looked at her. Her forehead had already beaded with sweat.

"Yeah?"

"Do you even know what his crime was?"

"He was caught sending covert transmissions to the Resistance."

"Bullshit." She gave the bag one last punch, then crossed the room. Her fist was still clenched, and I tensed, thinking she was going after my head. It wouldn't have been the first time. "Bullshit," she said again. "Even if he *was* helping the Resistance, that's not why they killed him."

I took a deep breath. It wouldn't help if we both got angry. "You know, I *am* your commanding officer. I should report such things."

"Report me, then," she shot back. "You want to see me up at the front of that room? I'll tell you why they took out Kaden. It's because he found out something they didn't want him to know."

"That's nuts."

"I'm telling you, the man was not a spy. I've been in his quarters and I would have seen the nex-link equipment. He said he wasn't sure we should trust the Unity Defense, but that's as far as it went."

I felt a pang of jealousy. She said she wasn't sleeping with him, and yet she was in his room? I suppressed the feeling. "And what did he find out?"

"Something they don't want us to know."

"Like what?"

"I'll let you know when I find out."

"Rina, I'm going to pretend I didn't hear that. The med probably found something you missed, that's all."

She shook her head. "You are so goddamn naive," she said. And then, on her way out, she muttered under her breath the most painful thing she had ever said to me. "I can't believe I wasted two years on you. I should have slept with your brother."

I was preparing to snap something at her about the value of loyalty, but the words died on my lips.

We coasted into the atmosphere under the cover of night, coming down over one of the major oceans to avoid detection. My visosuit enhanced and brightened the emerald waters beneath me. There was no land in sight. A flock of large, lizard-like birds were moving off to the north.

My group flew on in silence, with no need to speak because we had done this dozens of times before. Rina was with me. We hadn't spoken since the exercise room five days earlier.

By now, some teams had reached their targets, and I watched their ensuing battles on the monitor in my helmet. The Dulnari seemed particularly weak. One team was locked in combat with some ground troops, easily annihilating them. Another met hardly any resistance at all as they destroyed a whole fleet of sea vessels.

My team took out some pitiful attack

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pods with long-range missiles, then descended on the military base. Blue plasma bolts buzzed past, fired from the turrets below.

"Go to ground," I said.

As my boots hit the dirt, my suit reverberated from the impact. Dulnari soldiers, armed only with shoulder-slung rifles, streamed out of the single-story buildings. We mowed them down. There were thousands of Dulnari, though, and my team got separated, each of us dodging behind a different building. Still, I was confident we would have the planet contained in no time.

That's when I got the distress call from Rina.

"Vince," she said, "I need your help."

The tone of her voice made me freeze. I glanced down at her screen and saw something that didn't make sense. I was looking at her own face.

Then I realized: her helmet was off.

She appeared to be okay. She was looking straight at me, her black hair matted against her forehead. My suit's computer showed her only a hundred meters away, inside one of the largest buildings.

The Dulnari had the building surrounded, but I smashed through one of the windows. I ran down the hall, blasting dozens of Dulnari. I almost ran past her. She was hiding in a storage closet.

"In here," she said, yanking me inside.

She closed the door. It was a tight squeeze, our backs up against rows of shelving. There was one window on the far wall. Rina's exposed head looked puny, dwarfed by the bulky suit. There was a long, red gash along her forehead.

"You're hurt," I said.

She put a finger to her lips and scooted over to the window, the breastplates of our suits clinking against one another.

I saw then that her helmet sat on the ground, apparently undamaged. "Did you take it off?"

Explosions rocked the shelves, scattering dust over us, and dropping a few blankets on the floor.

"Rina," I said.

She looked at me. "I've figured it out, Vince. I figured out why they killed Kaden."

"Rina, we've got to get out of here."

"Come here. I want you to look out the window."

I looked outside. I saw two of ours crouched behind a burning, eight-wheeled transport. A number of the blue-skinned Dulnari littered the ground, but none of my soldiers. So far.

We shouldn't have been watching. We should have been out there.

"Rina . . ."

"Take off your helmet off," she said.

"What on Earth for?"

"It's the only way you will believe me."

"Believe what?"

I heard the guttural Dulnari voices out in the hall. I reached down and picked up her helmet. "Put it on."

She shook her head firmly. "No."

"Put it on!"

"No, listen to me. You're not seeing the truth. We're not fighting the Dulnari."

"What?"

She took my gloved hands in her own. "It's all a lie," she said. "A big lie, Vince. There's just the local military out there. Natives. The Dulnari must have left this planet long ago. Our suits, we thought they were so wonderful. They're just making us see what they want us to see, hear what they want us to hear. That's why they don't want us to take them off. We're not liberating. We're conquering."

I stared at her, trying to comprehend. Inside my helmet, I could flick from one screen to another of all the battles currently happening. My troops. My friends. Fighting for what they thought was right. She was saying it was all a lie?

"Take off your helmet," she said. "Vince, you can't just follow orders. You've got to think for yourself, too."

I was opening my mouth to speak when my brother's voice boomed inside my helmet.

"Major, what the hell is going on?" he said. "Is Private Pullman's helmet dam-

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aged?"

Rina was about to say something and I held up my finger.

"Sir . . ." I said, wondering how much to say. "Sir, I'm not sure. It may have malfunctioned, sir."

"Well, get it back on! Your men need you!"

"Yes, sir." I looked at Rina. "Yes, sir, we'll be re-engaging momentarily."

I handed her the helmet. The voices out in the hall were getting louder. Rina hesitated, then put the helmet back on her head.

"I won't shoot anyone," she said.

She looked dead serious. But when we left the supply closet, and the Dulnari were there at the end of the hall, she was faster at shooting them down than I was.

When I looked at her, she frowned.

"Training," she said, sounding disgusted.

The battle ended quickly. Rina fought, too, but I could see that her heart wasn't in it. When we returned to the ship, I ordered her to see the med to get the gash on her forehead treated.

"Vince," she said. "Don't make me. The plug'll throw me in the brig . . . or worse. Maybe brainwash me."

"Don't be ridiculous," I said.

She did as I asked, but there was a sullen, resigned look about her. I took a hot shower, letting the warmth seep into my aching muscles, then put on a clean uniform and went to see her. Damon would be expecting a debriefing. I needed to know what to tell him.

I still couldn't believe what she said was true. It had to be some kind of hallucination.

She wasn't in her quarters, so I assumed she was still in the medical facility. When I got there, the med was zipping up a black body bag. A single lamp shined its garish white light over the bag. No one else was in the room.

A cold feeling of terror swept over me. We had taken no fatalities.

"Where's Rina?" I asked.

Its silver head swiveled to face me. The light from the lamp gleamed on its metal scalp. Its solid black eyes narrowed. These were sentient beings, but they were not like us. No one I knew had ever become friends with a med.

"I'm afraid that Private Pullman's wound was fatal," it said.

"What?"

"Apparently the atmosphere—"

I pushed past the med and unzipped the bag. Rina's pale face, eyelids closed, lay before me. I touched her skin and found it cold.

"I'm sorry, Major," the med said. "I did all I could."

I couldn't believe what I was seeing.

"It was only a cut!"

"As I was saying, sir, apparently the atmosphere of Verexia contained an airborne virus which penetrated her blood stream through her wound. It brought about immediate heart failure. It's why it is vitally important our drop-soldiers wear their helmets."

Only an hour ago she had been fine. I glared at the med, wondering what it would take to rip the thing's head off. That it was a full foot taller than me and probably stronger by five times didn't concern me.

"You goddamn plug," I said, "you killed her."

The med was unfazed by my outburst. "Sir, I understand you are upset. However—"

"You killed her because of what she found out."

"I don't know what you mean."

My mind still had a hard time grasping that what Rina said was true, but she must have been onto something. A wave of nausea passed over me. My lovely Rina was dead. My Pair-o-Deuces. All because I didn't believe her.

"You saw what she saw," I said. "And what I saw. You know what she was saying."

"Sir, the transmissions from your visosuits were garbled. When I went back to review the recordings, I found there was

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no way to know why she lost her helmet. I was assuming you could enlighten us."

The med spoke with a chilling tone. I knew it was lying. It made sense. Of course the med would be the Unity Defense's lapdog, making sure everything went the way they wanted. The pieces were all starting to fall in place.

"I'm going to see Colonel Steed," I said, backing to the door.

"He already knows," the med said on my way out.

Of course the med would have informed the command officer if there was a death on the ship. How my brother would respond to the death of a woman he had once been infatuated with I didn't know. What I also didn't know was how much he knew about the truth—a truth I was still trying to wrap my mind around.

We aren't liberating, she said. *We're conquering.*

When I reached his quarters, I barged inside. He was at his desk. The computer screen, however, was off.

"Damon," I said.

He turned and looked at me. His eyes were red, his hair disheveled.

"Isn't it standard protocol," he began, "to knock before entering an officer's room?"

"The plug killed her," I said.

"What?"

"It killed her! It didn't like what she found out, so it killed her!"

He sighed. "I know it's hard for you to accept, but she's gone. You need to accept that and get on with your duties." He turned back to his blank monitor, as if it held something of vital importance.

I expected rage. I expected sorrow. But his voice was devoid of emotion.

"How can you be so callous?"

"I'm dealing with this in the only way I can," he said

"You know, don't you? You know the truth about the Dulnari."

"What are you talking about?"

"The Dulnari! We've already won the war. Our suits—our suits make us see Dulnari, but it's just the local life forms and whatever military they have. We're not liberating, we're conquering. It's the truth and you know it."

"That's nonsense. Where did you get that idea?"

"Like you don't already know. You saw the conversation Rina and I had. You know why she took off her helmet."

He got to his feet, looking puzzled. "No, I didn't. I only saw a few seconds. The med informed me the transmission was garbled."

"That's another lie."

"Major," he said, holding up a finger, "I'd watch what I was saying if I were you."

"Don't you think it's odd the Dulnari have extended their empire so far? That they have so many planets under their control?"

"Major—"

"The terrorists are right. What we're doing is wrong."

"Major! Your statements are bordering on treason. If you don't—"

"Damon, you know Rina. She wouldn't make this up. I'm not totally sure myself, but don't you think we need to find out before we kill anyone else?" I swallowed, pausing before delivering the line I knew would get through to him. "What do you think Dad would say if he knew we were killing innocent people?"

The punch to my cheek was swift. He hit me so hard I fell over backwards, landing on the floor. The blow brought tears to my eyes. I lay there, stunned, looking up at him.

"Don't you *ever* talk about our father that way!" he shouted "He served with distinction, Vince!"

It was the first time in as long as I could remember that he had used my first name. I could make him angry. And if I could make him angry, I might be able to make him see beyond his uniform.

"Damon, *be* was right," I said, massaging my cheek. "Back then, he was still fighting Dulnari. But now—"

"Not another word," he said.

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"But—"

"Not another word! I swear, Vince, you may be my brother, but if say one more treasonous word, I'm going to turn you over to the med." He stood there, breathing hard through his nostrils, as if waiting for me to challenge him. "You have two choices," he went on. "You can continue to piss on what we're doing, or you can get off your ass and get on with your duties. Which is it going to be?"

There were a hundred things to say leaping through my mind. But instead of saying any of them, I got off the floor and headed to the door. There was no reasoning with him.

I would have to find another way.

I didn't sleep that night. Instead, I tossed in my bunk, Rina's words echoing through my brain.

Vince, you can't just follow orders. You've got to think for yourself, too.

She was right. Who knew how many innocent people had died because of me—the last being the woman I loved? I could have resigned immediately from the Unity Defense. Service wasn't mandatory. But I couldn't let any more innocent people die, and I couldn't let my brother take part in it either.

We had chased the enemy into a canyon, and now we were up on a ledge, looking down at them huddling behind the boulders below. The vegetation was sparse and withered-looking. It was dark, but of course our suits made it seem brighter.

I realized there were hundreds of planets where wars were being fought by liberation squads right now. We were only one of them.

Hundreds of planets.

Hundreds of lies.

There were thirteen Dulnari—or what I knew *weren't* Dulnari, but what my suit showed me were. Now and then, one popped up from behind a boulder and fired at us with a pitiful projectile gun. They couldn't even leave a scratch on our suits. Absurd, I thought, that anyone could think the Dulnari could have sunk to fighting with such meager weapons.

I had arranged the drop so that we did a major offensive first, keeping all my soldiers together, telling them not to kill until we had them surrounded. My soldiers were on their stomachs, lined up on the edge. I looked up at the three moons, two of them full. The visosuit made the moons seem like pale yellow disks, but I hoped they would provide the light I needed.

"Sir?" one of the men said. "Sir, should we fire?"

Who was it? Number Seventeen. I couldn't remember the name.

"Hold your fire, Private," I said.

"But, sir—"

"That's an order."

The enemy continued to fire. Now and then, their shots grazed the canyon's edge. After a moment, my brother's voice boomed inside my helmet.

"Major Steed, what the hell is going on?" he said.

"Absolutely nothing, sir," I said.

"I can see that. Finish the enemy so we can get out of here."

"Negative, sir."

"What?"

"I can't follow that order, sir."

"Major, if you don't—"

"I'm perfectly aware of what I'm doing. Steed out."

Procedure required him to do one thing. If the major in the field couldn't carry out a drop, then it was up to the colonel to take over. It also meant the med would accompany him, because it was assumed the major would be injured.

My soldiers continued to look at me, hungry for me to give the order to attack. It wasn't long before we saw the pod streak out of the sky. Braking thrusters fired and the pod landed a few dozen feet away on eight spidery legs. When the bottom hatch popped open, two figures emerged—my brother, wearing a visosuit, and the med, needing none of its

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own.

"You better have a goddamn good reason for this," he said over the suit-to-suits. As they approached, I could see that the med was carrying a laser rifle.

Before they got too close, I did what I had been waiting to do. The planet had a breathable atmosphere.

I reached up and popped off my helmet.

Both Damon and the med pulled up short. I let the helmet fall to the ground. The air was cool and thin. The moonlight was bright enough: not only could I see the astonished faces of my brother and my soldiers inside their black helmets, but I could also see what was down in the canyon.

The faces and bodies of our enemies were covered with shiny black fur. They were much shorter than us, the size of our children, with four arms instead of two. Even at a glance, it was apparent they weren't Dulnari.

Rina had been right.

"What the hell are you doing?" Damon cried.

The med was walking forward. "This is a clear violation of protocol," it said, its shoulder rifle pointed at me. "Major Steed must be taken into custody at once."

"Don't come any closer," I said, and the tone of my voice was enough to make the med hesitate. "Damon, take off your helmet. You've got to see what I see to make up your own mind."

He didn't answer.

"Damon . . ." I said. "Damon, it's all lies. We're killing innocent people. We're not—"

"Stop!" the med cried. Curiously, the enemy had stopped firing, as if they knew something was happening. The med started forward again. "Major Steed is uttering treasonous lies."

One pull of the trigger and I would be dead. The suits were strong, but I had chosen to take off my helmet, and the med had the laser rifle pointed right at my face. If I even made a movement to bring up my finger lasers, I knew the med would gun me down.

"Damon!" I shouted. "Take your helmet off! It's the only way you'll know!"

The med turned and looked back at my brother. I waited for him to do something.

"Take him into custody," Damon said.

"Yes, sir," the med replied.

My heart sank. So this is what I meant to him, I thought. I couldn't even get him to take the helmet off.

Rina had died for nothing, and so would I.

But then, as the med headed for me, I heard a blast. I jerked, thinking it was me that was hit, but then the med went down. Even in the dim light, I could see the charred hole in its back. I looked up and saw my brother lowering his hand. The soldiers stood motionless, as if afraid to move.

"I had to get it to turn around," he said.

And then, without another word, he reached for his helmet.

The list of the dead grows everyday. My father died protecting us. Rina died because she didn't want to live with a lie. My brother and I, we're still fighting, but it's no longer a certainty we'll win this war. We've joined the Resistance. When the soldiers of the LS-37 took off their helmets and saw what we saw, all of them joined us.

When we were on our way, Damon turned to me and asked, "Do you think Dad would approve?"

"If he knew what we know," I said.

Our father died fighting for something noble—liberating those who suffered under the tyranny of the Dulnari. There was no way I could know what he would do, but I *believe* he would not fight an unjust war. A war with no true enemy, only victims.

I believe that, knowing the truth, he would do as we have done.

I believe that he would throw off his helmet and fight—in daylight, in darkness—with his eyes open. ■

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The Aztec Supremacist

Sheralyn Schofield Belyeu

Is the sensible decision always the best decision?

Dr. Harvey and two security guards materialized beside the road to Granada, Spain, in January 1492.

The Hispanic guard, Carranza, noticed the change first. "Where's Columbus? I don't see Columbus."

Dr. Harvey stared around them, his concern quickly turning to fear. "I've watched this morning through the viewer a hundred times—he should be right there by now." He pointed at a rock a few feet away. "I wasted too much time trying to repair the controls—we should have come through the portal right after the Aztec supremacist did."

"I wish I'd shot him when I had the chance," Carranza groaned.

"Shot him for what—looking funny?" The Asian guard, Jason Rhee, climbed up on a rock and scanned the countryside through binoculars. "Half of the graduate students show up in period costumes—some of the academics, too. How were you supposed to know he wasn't really from Berkeley?"

Carranza's voice shook with frustration. "I should have stayed in the room for the demonstration, then. I could have grabbed him when he left his seat."

"They were *all* out of their seats at that point," Dr. Harvey answered bitterly. "And the viewer was on, so the lights were dim. I had them at the control station so they could see how to lock the tracer onto a specific person."

Rhee lowered his binoculars and pointed back up the road toward the Spanish encampment. "There's Columbus—and the supremacist is with him!"

The travelers didn't know how long the continuity bubble would last—or what would happen to them if the new timeline condensed—but they knew they were their timeline's only hope. They went toward Columbus at a run.

When they reached him, Dr. Harvey's heart sank. The supremacist was smiling.

"You see, Columbus, my witnesses took a little longer than I expected, but

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they have joined us, just as I said they would." He backed away, holding his hands up so the travelers could see he was still unarmed. "Ask them if I have not told you the truth."

Even in his pseudo-peasant costume, the supremacist was out of place here—no one in Old Spain had seen American Indian features before. But, wearing twenty-second century street clothes, his pursuers looked ten times worse. The few people still around, those who hadn't seen the travelers' unnatural arrival and panicked, crossed themselves and slipped away.

Columbus, white and shaken, stood his ground beside his mule. "Gentlemen, this person tells me that in many years, the Almighty will allow men to journey through time. He says that he has come from the far future with a message for me. A warning."

The chrono-physicist swallowed his dismay and bowed deeply to Columbus. "Sir, please forgive me for appearing before you dressed like this. I am this poor madman's physician. As you can see by our peculiar appearance, we came after him as quickly as we could." He made eye contact with each of the guards and tilted his head toward the supremacist. "With your kind permission, we will take him home and confine him more securely. He will not bother you again." Guns out, Rhee and Carranza moved to either side of the supremacist.

The supremacist laughed. "And you're a perfectly ordinary doctor who vowed to wear funny clothes as a penance for your sins, right? Nice try, Dr. Harvey, but he's not going to buy that. I brought proof that we're from the future." He pointed to the ground around Columbus. It was littered with little things—a butane lighter, a solar-powered pocket computer, a flashlight, a wristwatch. All in bright, impossible colors, all made of plastic. Dr. Harvey could have cried.

"What else did he say?"

Columbus indicated a letter clenched in his hand. "He says that Ptolemy's map of the world and Marco Polo's geography of Cathay were both wrong. Cathay is twice as far away as I calculated! He says I will reach some small islands with no spices and little gold. He says," his voice shook with emotion. "He says I will be put in irons and brought back to the court in shame. This is true?"

Jason addressed Columbus by his Spanish name and title. "Señor Colón, my name is Jason Rhee. As you can see, I am from Cathay." Not strictly true, but this was no time to explain Rhee's Korean grandparents to a fifteenth century European—not even to a bright man who read speculative geography. "Although you did not quite reach my country, your name will be held in great honor."

The supremacist laughed aloud. "Great honor, my foot. You're a plague carrier—your victims will curse you and die! Even the Spanish won't love you for long—they'll mock your sons, Columbus, and tell lies about you. And they won't name the lands you'll discover after you. They'll name them after Amerigo Vespucci!"

Rhee punched the supremacist and Carranza fought to put him in an arm lock. Dr. Harvey raised his voice above the sound of the struggle. "The islands you'll discover are part of a—a great chain. The chain will be named after Vespucci, but your name will not be forgotten—my home town is Columbus, Georgia!"

Columbus' face reddened with his famous temper. "Vespucci gets my islands and I get a town?"

Panting from the struggle to hold the supremacist, Ramón Bernardo Carranza de O'Higgins played their last, desperate card. "Don't you see what he's doing? This man did not come here to help you; he is an idolater, a descendant of the idolaters you will find beyond the great ocean! He knows that you will bring Christianity to his people and save them from their demon gods! Do not let him turn you from your divine mission!"

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The supremacist chose that moment to drop a crucifix at Columbus's feet.

Columbus studied them all. When he spoke again, his voice was grim. "Perhaps he is an idolater, but he brings me proof. You come in violence with nothing but your own words—and you admit that what he says is true. Perhaps *you* are the idolaters and *he* is the true Christian. Let him go while I think."

At a nod from Dr. Harvey, Carranza released the supremacist.

Columbus quickly skimmed the letter in his hand. "First, the gold. I need it to finance a new crusade, to free the Holy Land from the Mohammedans. But this letter says that the king and queen will break our agreement and deny me my rightful share of what little gold I find. Is this true?"

Dr. Harvey started to tell Columbus that it wasn't true, that there would be plenty of gold if he would just make the voyage. But he had only gotten out the word "No!" when Rhee reluctantly nodded a yes, and Carranza choked out, "A crusade is not important right now."

Columbus said nothing for a moment, his expressive face suddenly closed and guarded. The supremacist smirked.

Columbus referred back to the letter. "Scurvy. He says that sailors will die of scurvy trying to reach Amerigo Vespucci's islands. He says that many years from now, men will learn what causes scurvy and the sailors will not suffer so. Is this true?"

This time, only Dr. Harvey answered. "Well, yes, but—"

"And he says that men will learn how to navigate more safely. An Englishman will invent a machine to keep accurate time at sea. Then captains will be able to calculate their exact speed and position. Without my 'pathetic guessing.'"

"Harrison's chronometer won't be marketable until the late 1700s! By then—"

Columbus cut Dr. Harvey off with a wave of his hand. "Is it true that two-thirds of the men who make these voyages will die at sea or on Vespucci's islands?"

Dr. Harvey sounded desperate now. "The percentage depends on which voyages you consider! If you include—"

"So you admit that if I sail west now, I will neither reach Cathay, nor free Jerusalem, but many men will die going to Vespucciland?"

Dr. Harvey never answered.

The new timeline condensed, the continuity bubble collapsed, and all four of the time-travelers disappeared, their "proofs" fading away with them.

A few minutes later, Queen Isabella's court bailiff found Columbus standing beside the deserted road.

"Señor Colón," he cried, "I have news for you—good news! Santangel begged the queen to reconsider your requests, and she relents! She summons you back to the court. Señor Colón, she will sponsor your voyage to Cathay!"

Columbus did not speak at first. He looked down at his hand, where the letter from the future had rested just moments before. Then he raised his eyes to meet the bailiff's face. "I am sorry, sir, sorry that I have wasted so much of her time with this foolishness. The queen's advisors were correct. I cannot reach Cathay by sailing west."

Columbus looked ten years older, his great dream dead. "Perhaps our descendants will go there someday. When it's safe to explore the world." ■

I was so long in writing the review that I never got around to reading the book.

—Groucho Marx

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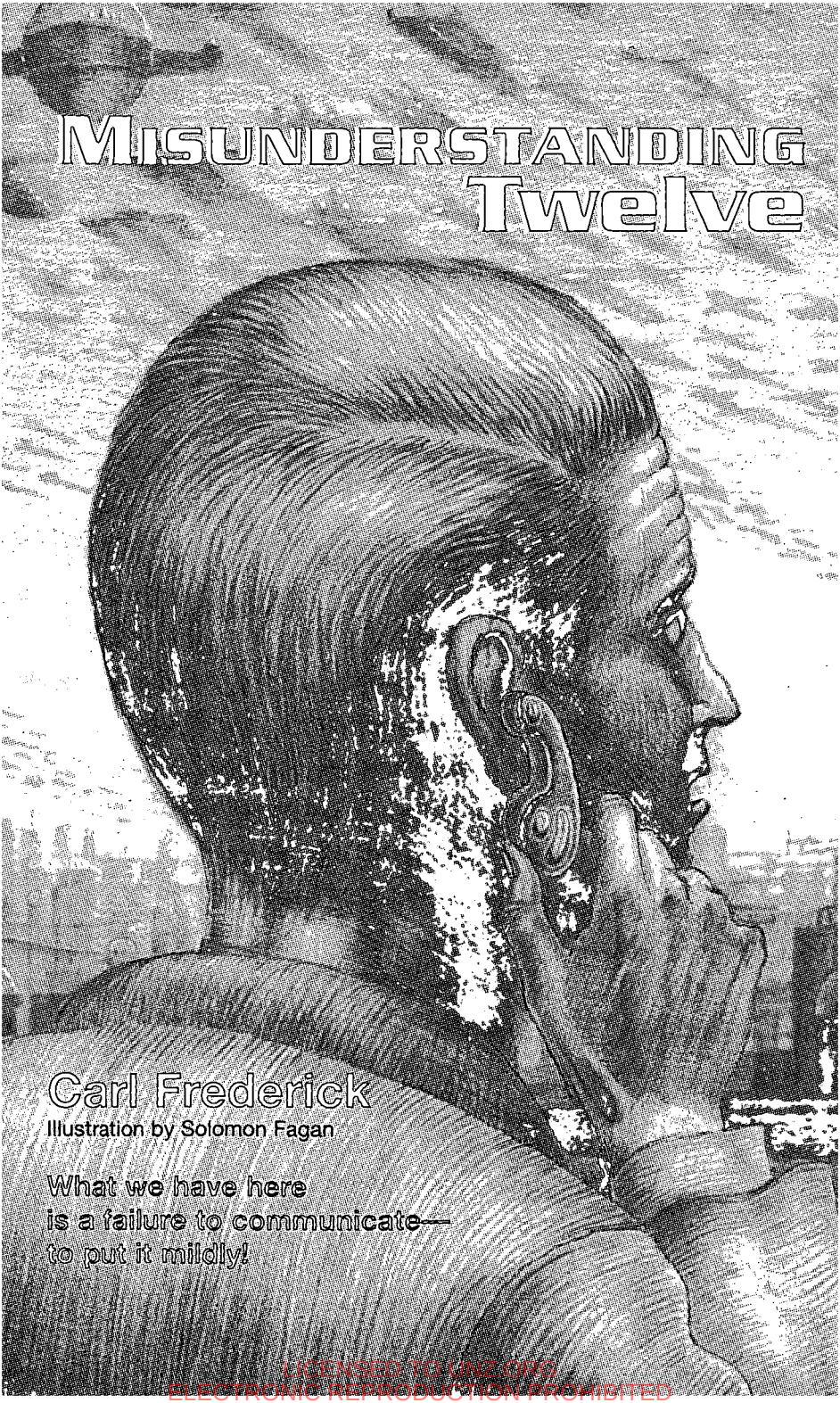
Misunderstanding Twelve



Carl Frederick
Illustration by Solomon Fagan

What we have here
is a failure to communicate—
to put it mildly!

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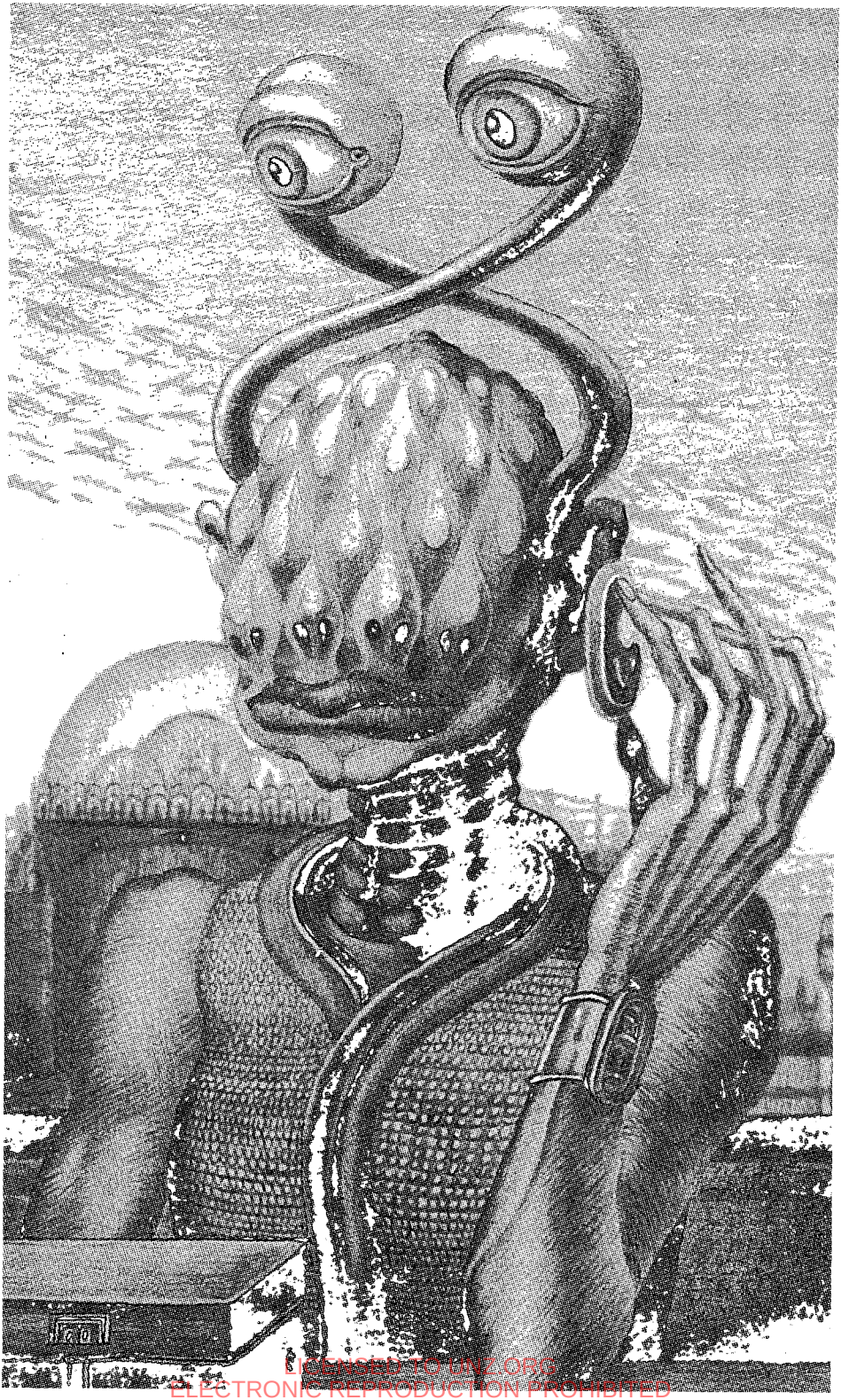

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Roger zoomed his gyroscooter through the streets of Free-trade City. But even just standing on the scooter took considerable effort in the 1.2 Earth-norm gravity and the chill winds of Delva in summer. Still, it would be worth it if he could finally impress his boss.

At an intersection, he stopped to make way for a clear-domed state touring-vehicle. Roger bristled as the Delvan lounging in the back seat looked down his nose at him—down his long pig-like snout—and gave a condescending nod as if he owned the galaxy. But then, the Delvans practically *did* own the galaxy. Delva monopolized interstellar trade, leaving only crumbs for other planetary civilizations. And even those meager contracts had to be negotiated in Free-trade City.

When the touring-vehicle had passed, Roger gunned his scooter. Just ahead, he could see the Nril Trade Embassy. It was almost as small as the Terran facility. But then again, Earth was new to the Oxygen-breathers Trade Federation.

Roger pulled into the parking area of the Nriln complex, stasis-locked his scooter and, feeling far older than his twenty-seven years, trudged toward the door.

Inside, as the door whooshed shut behind him, he took a deep breath and slowly exhaled the sweet air. The Nriln preferred an even higher oxygen-level than did humans.

Roger switched on his translator. All trade operatives in the city had received one as a "Welcome to Delva" gift. But the translators were unpredictable. Internally, they used Delvan as an intermediary language. With such a huge number of languages in the galaxy, it was the only way that every language could convert to every other. But it made for some awkward translations.

Roger walked up to a Nriln sitting behind the reception desk.

The Nriln were humanoid, roughly human in size, had two eyestalks and two six-fingered hands. They had a mouth for eating, breathing, and talking. In addition, they had four small noses. These noses had vocal cords and could each produce a variety of simple tones. Just an hour ago, Roger had discovered why those noses made the Delvan-translators unreliable.

"State your language," said the Nriln, pressing the 'Identify Language' button on its translator.

"AngloTerran."

"I bid you no welcome," said the Nriln accompanied by a slew of nose tones.

"Thank you." Roger didn't take offense. He understood the translator's shortcomings. "Could you speak your written language, please?"

"Yes, of course I could."

Roger rolled his eyes. "Then do it. Please speak the written language."

The Nriln snapped back in its chair, its eyestalks quivering. Then it seemed to relax. "Our spoken language is ugly and capable of no subtlety," said the Nriln. "We are maximally contemptuous of it."

"Please."

The Nriln swiveled its eyestalks in a furtive scan around the entrance hall and then repointed them at Roger. "It is maximally rude of you to ask," said the Nriln, very softly and with subdued nose-tones. "But since you are obviously an alien with knowledge zero of our ways, I shall speak the written language."

"Thank you," said Roger. "I'm from the Terran Unified Trade Embassy. I'm the AngloTerran Junior Cultural Liaison."

"Whom are you here to see?"

"Duncan Frye, the AngloTerran Trade Commissioner."

"Maximally unfeasible," said the Nriln. "We would have to hold him down. And it would take a lot of oil."

"What?"

"Is it an Earth ritual of some sort?" The Nriln crossed its eyestalks.

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Sheesh. Roger threw a glance at the ceiling. *Damned Delvan-translators.* He tried to look the Nriln directly in the eyes, but the creature's independently-moving eyestalks made that difficult. Roger spoke slowly. "I've come to see the AngloTerran Trade Commissioner, Mr. Frye. He's here negotiating for the purchase of yttrium from Nril."

"Excuse the misunderstanding." The Nriln consulted a computer monitor, then pointed down a hallway. "They are in not-particularly-grand conference-room number one four."

"Thank you."

Roger hurried down the hallway, counting doors as he went. They were each dual-labeled in what appeared to be Nriln and Delvan, but Roger could read neither language. He tried the fourteenth door, but the room was empty. Then he had an idea. The Nriln had six fingers per hand so their number system was probably base-twelve. Fourteen base-twelve would be sixteen base-ten. Roger went two doors further and then heard Duncan's frustrated voice coming from within.

"No, no. A mining-ship is not another kind of partnership. Please. Try to understand."

Roger tapped on the door and walked in. He saw Duncan sitting at one side of a rectangular conference table and two Nriln sitting opposite. As he entered, Duncan looked over at him and the Nriln moved their eyestalks further apart. Roger gave the "time out" sign and padded up to Duncan. "Excuse the interruption, sir, but I've just learned something about the Nriln language—something that might make the negotiation go more smoothly."

"Oh?" said Duncan, raising his eyebrows. He looked every bit the career diplomat: early fifties, immaculately attired, manicured fingernails, although God knows where he found a manicurist on Delva. And he seemed a man very comfortable with his job.

"I've been info-diving the computer," said Roger. "And I've found out why it's so hard to understand spoken Nriln."

Duncan turned to the Nriln. "I'm sorry for the interruption, but my young colleague has just informed me of something that requires my immediate attention. Might I beg a short recess?"

The Nriln agreed and the Terrans went out to the hall for a talk.

"So Nriln is tonal," said Duncan, lounging against the wall of the corridor. "Many languages are tonal."

"Not exactly tonal," said Roger, trying not to sound as if he were lecturing. "More like polyphonic. The Nriln language uses functionals. A single word is used for a concept and its opposite."

"That's it?" said Duncan. "It seems a small thing compared to say, Trelgvar, for instance, where the noun forms depend on the weather."

"Yeah, I know," said Roger. "But in Nriln, next to an adjective, they put a number from zero to twelve to give the meaning."

"I'm not sure I understand. And why does it matter? The Delvan-translators should take care of it. I don't think this has any—"

"No, wait," said Roger. "Let's invent a word. Badgood. Badgood zero would mean very very bad, badgood twelve would mean very very good, and badgood seven would mean so-so in the bad-good domain."

"But I still don't see—"

"That's for the written language. But in speech, especially the flowery speech of politicians and diplomats, they leave out the numbers."

"That's ridiculous," said Duncan. "How could they understand each other?"

"It's the tones." Roger tapped his nose. "They indicate emotional content. But the Nriln often use tones for numerical information as well." Roger shrugged. "I'm not even sure they know they're doing it."

"Ah." Duncan nodded in comprehen-

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sion. "It's like the grand opera you're always singing around the office."

"Well, yes, sort of." Roger laughed. "Grand opera where the orchestra is made up of badly tuned bagpipes."

Duncan glowered.

"Ur," said Roger. "Duncan Frye is a Scottish name, isn't it?"

"Yesssss."

"Sorry." Roger bit his lower lip. "About the bagpipe comment, I mean," he added, quickly. "But anyway, now we know why it's so hard to understand spoken Nriln. The translators don't interpret the tones."

"Couldn't we just ask them to speak their written language?"

"I don't think so," said Roger. "I've learned that it's very rude to ask that."

"Yes, they do seem exceptionally touchy about their language." Duncan rubbed his forehead. "Even more so than the French. But please tell me you have a solution. I'd like to get this yttrium contract negotiated."

"Well, as you say, I'm a grand opera fan. With a little effort, I should be able to give you a rough idea of the missing functional-numbers."

Duncan blew out a breath. "Are you sure? Max is a very high-level official—shipped in just for this negotiation."

"I'm pretty confident." Roger wrinkled his nose. "Max? You said the Nriln's name is Max?"

"More like Magszh. But I just call him Max. I don't think he notices." Duncan straightened his tie. "All right. We'll give your idea a try. Let's go in and negotiate. Oh, and the other Nriln is named Vurzh. He's the senior trade Kurzsher."

"Kurzsher?

"I don't know what it means." Duncan shrugged. "I expected you to know."

Back in the conference room, Duncan made introductions. Then Max stood and began to sing.

Roger shot Duncan a quizzical look.

"It's a welcoming speech; I think," Duncan whispered. "Scared the hell out of me the first time I heard it."

"And, I imagine," said Roger, "that the Delvan-translators are useless."

"Totally."

Roger leaned back in his chair and tried to look intelligent and comprehending. It was a skill he'd picked up in graduate school.

When Max had finished singing, he drooped his eyestalks for a moment. It seemed something like a bow.

Max sat and as he did, Roger jumped to his feet.

"What are you doing?" said Duncan, softly.

"I'm going to sing."

"You're what?"

"Tit for tat," said Roger. "He sang. Now I'll sing."

"I'm not entirely sure this is a good idea."

"We don't understand them," said Roger. "We should at least give them the chance not to understand us." He bowed toward the two Nriln. "They say that music is the universal language."

"We'll see." Duncan shrugged. "You're the cultural expert."

Roger took a breath and then started singing. *Largo al factotum della città. La la la la la la la la!* He looked over at the Nriln. He knew he was having an impact; they had crossed their eyestalks. *Figaro. Figaro. Figaro. Figaro. Figaro!* Now they were talking to each other and gesticulating at him. *Figaro qua, Figaro là, Figaro qua, Figaro là, Figaro sù, Figaro giù, Figaro sù, Figaro giù.* Roger was pleased with himself. He'd never sung this aria so well, and never to an audience. *Ah, bravo Figaro! Bravo, bravissimo; Ah, bravo Figaro! Bravo, bravissimo; a te fortuna, a te fortuna, a te fortuna non mancherà.* The Nriln had uncrossed their eyestalks and were staring straight at him. *Della città, della città, Della città! La la la la la la la la!*

Roger bowed again. The Nriln began walking toward him.

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He turned to Duncan. "I think I impressed them."

"You impressed them, all right," said Duncan. "They probably think you're out of your mind."

The Nriln stopped in front of Roger. "That was certainly the worst oratory we've ever heard," said Max in a scream of nose-tones.

"I thought as much," said Duncan.

Roger's face clouded, but then brightened. "Wait," he said. "It's the nose tones. He means that it was the *best* oratory they've ever heard. I'm sure of it. And 'oratory' can mean 'singing,' I think."

Roger beamed at Max. "Thank you," he said. "Thank you very much. I used to sing in college, you know."

"Please come with us," said Max. "We will send someone down to attend to you."

"I think he really did mean 'worst,'" said Duncan as an aside.

Max swiveled his eyestalks to Duncan. "You come too—to calm your colleague."

"I'm calm," said Roger.

"Come." Vurzh put an arm around Roger's shoulder and urged him toward the door.

"I'm calm," Roger shouted.

"I can not believe this," said Max. "At a trade negotiation, this Terran comes in and maximally ridicules our language by engaging in an oratory of nonsense words."

"Ridicule? No." Roger tried to escape Vurzh's hold, but the Nriln's grip was solid. "And they weren't nonsense words. It was a language called Italian."

"Italian?" said Max. "I have never heard of the planet Italia." He wriggled his eyestalks in derision. "And what kind of a word is lalalalalalalalala?"

"Italian is a Terran language, I think," said Vurzh.

"What, another one?"

"Yes," said Roger. "Earth has lots of languages, but—"

"And lalalalalalalalala?" said Max, not even bothering to cross his eyestalks.

"Well, yes," said Roger. "I admit that was a nonsense word but—"

"Deranged," said Max.

"No doubt," said Vurzh. "We must bring them down to the contemplation-room, and then see if Ingvrau is in the building."

"Agreed." Max turned his stalks toward Roger. "You are an alien, so we make allowances. But if you were a young Nriln, you would be beaten for committing crimes against language."

"That is," said Vurzh, "if you were judged sane."

"Why couldn't your hobby be stamp-collecting or something?" said Duncan. He paced back and forth in the small room. "But no. You had to be a singer."

"Sorry," said Roger. "I really thought it was a good idea."

"Good idea, indeed." Duncan tried the door. It was locked.

The room had a couch and a few overstuffed chairs that could accommodate either Humans or Nriln. The floor was springy and soft, rather like a plush carpet, and the walls had the same bouncy consistency. Diffuse whiteness radiated from the surface of the high ceiling, casting light without shadows against the furniture and the pale blue walls.

"Contemplation room?" said Roger, as he glanced around the enclosure. "Jeez! It's more like a padded cell."

"No kidding," said Duncan. "I have no idea what the Nriln do with nut-cases."

"What do you mean, 'nut cases'? It's just a simple misunderstanding." Roger ran his hand over the soft wall. "Hmm. This stuff is a pretty good sound absorber." He turned to Duncan. "In any case, our embassy will straighten it out."

"I wouldn't be so sure." Duncan shook his head. "Technically, we're on Nriln soil; we're subject to their laws."

Just then, the door opened and a plumpish Nriln walked in. "Hello," he said. "They told me you show only minimal plus one signs of violence." He

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spoke with a low, steady, calming drone of nose-tones. "My name is Ingvrau."

"You're a psychiatrist, aren't you?" said Roger.

"Why do you say that?" Ingvrau plopped down on a chair. "Why do you think I'm a psychiatrist? And does that disturb you?"

After Dr. Ingvrau's visit, Roger felt better. "I like this Ingvrau," he said. "He talks very quietly and speaks the written language—and his nose-tones are rather pleasant."

"Probably trying not to rile his patients," said Duncan, recumbent on a couch.

Roger sat on the edge of one of the chairs, his chin cupped in his hands. He glanced over at the door. "Anyway, I think he believed me when I explained it was just a simple misunderstanding."

"Let's hope."

There came a noise at the door. Roger sprang to his feet as Ingvrau walked in. Duncan swung up to a sitting position.

"All is forgiven," said Ingvrau with a pleasant wave of his eyestalks. "Magszh and Vurzh cordially invite you to return to the negotiations."

"Very good," said Duncan as he rolled to his feet. "Let's go." He cast a sideways glance to Roger. "And no more singing, please."

"No, sir," said Roger. "No more singing."

At the door of the conference room, Ingvrau took his leave. "It has been a maximum minus two pleasure meeting you." He widened his eyestalks, then narrowed them again, turned, and walked off.

"Very expressive, those eyestalks," said Duncan, watching Ingvrau disappear down the hallway.

"Yeah. It's odd though," said Roger. "I've never seen Nriln use hand or arm gestures."

Duncan reached for the door lever. "Let's go in. But be careful."

Max and Vurzh stood as Duncan and Roger entered the room.

"It is bad having you back with us," said Max.

"Yes," said Vurzh. "I trust you are feeling worse, now."

Roger smiled. *Damn Delvan-translators.*

"Thank you," said Duncan. He walked to his seat at the table and sat.

Roger followed, but before sitting, he waved at the Nriln, bringing his hand to his forehead in the manner of a salute.

Both Nriln jumped back.

"Again, he insults us," said Max, his eyestalks quivering.

"Maximally unbelievable." Vurzh's nose-tones were soft to the point of silence.

"I too am maximally stunned," said Max, his nose-tones also barely audible.

"We could have done these negotiations by phone," said Duncan. Again, he paced the small room. "But no. You had to insist I do them in person."

Roger, wide-eyed and confused, leaned against the spongy wall of the room. "What happened?"

"Apparently," said Duncan, "your little military salute didn't go over particularly well. Probably an obscene gesture or something."

"Jeez." Roger leaned his head against the wall.

A few minutes later, Max and Vurzh entered the room. Vurzh carried a long, thin case.

"Look," said Roger. "I can explain. I just meant—"

"Be maximally quiet," said Vurzh, his nose-tones still subdued. He opened the case. In it were two black rods, each about three feet long and a half-inch in diameter. "Choose one," said Vurzh. "Magszh will take the other."

"Wait," said Roger. "This is just a misunderstanding. I only—"

"Choose!"

Roger lifted a rod from the case. It was lighter than it looked and had a whippy flexibility. Max took out the oth-

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er rod and made a few passes in the air with it.

Roger looked across at Duncan. "Do you have any idea what's going on?"

"I think you've been challenged to a duel."

"What!?"

"We go now to prepare the hitting room," said Vurzh. "We will come back for you soon." He turned toward the door.

"Wait," shouted Roger. "Please. Could you have Ingvrau sent down here?"

"As you wish," said Vurzh.

"It is your right," said Max.

The two Nriln left and Roger heard the click of the door-lock.

Duncan stretched out on the couch. "Interesting. It's sort of like one of those comic operas you like so much." He gave a short chuckle. "I wonder if their nose-singing causes their histrionic behavior, or if the behavior is at the root of the singing."

Roger, standing in the middle of the room, stared down at the rod he held. "This isn't funny," he said. "Getting hit with this thing could really hurt."

"I think that's the general idea."

Roger threw down the rod. It bounced on the springy carpeting. "Well, I'm not playing this game. I'll refuse the challenge."

"Do you think you can get away with that?"

"How the hell should I know?"

"Well," said Duncan. "You *are* the Cultural Liaison. You should know these things."

"*Junior* Cultural Liaison," said Roger. "And I've only been on Nril for a few Earth-days. I can't be expected to know everything yet." He stalked over to a chair, sat, and sulked. Things were going dreadfully; he'd twice fouled up a delicate trade negotiation, he shown himself ill prepared for his job, and now he'd just been very rude to his boss. For an instant, Roger wished he were a little kid; then at least, he could cry.

* * *

Roger was sulking still, when Ingvrau entered the room.

"I hear that you have done it again," said Ingvrau as he walked up to Roger's chair. "You have favored Magzh with the maximally unspeakable gesture." Ingvrau spoke with heavy nose-tones, apparently too distraught to speak the written language. "I am beginning to doubt your sanity." Ingvrau made an eyestalk gesture that Roger didn't comprehend. "I should not have said that about your sanity." Ingvrau's tones subsided. "It was maximally minus two unprofessional of me."

Roger stood and, making sure his hands were safely in his pockets, tried to speak slowly and rationally. "I'm sorry. The gesture was a mistake. I didn't know it was obscene."

"How could you not know? You are a trade negotiator. You should be at least ten familiar with our culture."

"Ha," said Duncan from the couch.

Roger shot a glance at him, then appealed to Ingvrau. "Please," he said. "I don't want to duel. I refuse to accept Max's challenge."

"You must. Otherwise, they will just hold you down and beat you with the stick." Ingvrau quizzically crossed his eyestalks. "I do assume your species feels pain when beaten. Yes?"

Duncan walked over. "It really was just an innocent mistake," he said. "Could you perhaps go to Max and offer him our sincere apology? I don't really think there is a need for violence."

Ingvrau didn't answer, but his nose-tones sounded ominous.

"Please," said Duncan. "For the sake of interstellar understanding as well as commerce."

Ingvrau emitted a warbling set of tones. "Yes. Very well. I will eleven attempt to explain your actions to Magszh." He walked to the door. "It may take me so-so in the long-short time domain."

When next Ingvrau came to the

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room, Max, still carrying his stick, walked in behind him. He came up to Roger. "The hitting room is ready."

"What?" Roger looked over at Ingvrau.

The Nriln psychiatrist gave a stalk gesture that Roger now recognized as a shrug. "It is out of my hands," said Ingvrau. "The duel must go on, I maximally fear. One offense, Magszh could overlook, but not two." Ingvrau shrugged again. "Two strikes and you are out as you AngloTerrans say."

"That's three strikes," said Roger.

"Really?" said Ingvrau. "How maximally minus one permissive of you."

Duncan, standing off to the side, furrowed his brow and then walked up beside Roger. "Excuse me," he said, looking at Ingvrau. "How did you know about our sayings? The Delvan-translators certainly didn't tell you that."

"It is our specialty," said Ingvrau. "Cultural studies. In fact, the Delvan-translators, as you call them, were developed by us Nriln. We just licensed—"

"Stop," said Max, in a rising flurry of tones. "That is secret. Our contract with the Delvans forbids you from talking about this." He lowered his eyestalks so they flopped down over his face.

"But that doesn't make sense," said Roger. "The translators all use Delvan, not Nriln as an intermediate language."

Max ignored him. "I have maximally failed in my obligation," he said to Ingvrau. "I zero know what to do. We are in breach of contract. The Delvans could sue us and get ownership of the technology." He walked to a far chair and plopped down. Ingvrau went over and appeared to be comforting him.

Duncan turned to Roger. "It does make sense," he said. "I'd bet the Delvans negotiated an exclusive contract and demanded that Delvan be the intermediary language." Duncan shook his head. "Damned clever, these Delvans."

"I don't understand."

"Look," said Duncan. "Everything is translated to Delvan, and then from Delvan to the target language." Duncan raised a finger. "Except for Delvan."

"I still don't get it."

"With no intermediary language the translation is smooth. Everyone feels it's easy to deal with the Delvans. It's like the Delvans speak a similar language."

Roger thought about it for a moment. "And that must be why the Delvans pretty much give away the translators." He shook his head in wonderment. "There's no competition in translators, and the Delvans can just go and gobble up all the good interstellar trade deals."

"I think," said Duncan, "that there's more in play for us here than just a yttrium contract. I've got to verify this." He walked over to the Nriln. Roger followed.

Duncan glared down at Max. "If it's your technology, then why isn't Nriln the intermediate language?"

Max didn't answer, and Ingvrau turned his eyestalks to stare at his feet.

"Come on," said Duncan. "You might as well tell us. The cat's out of the bag, now."

Ingvrau looked up, his eyestalks crossed in puzzlement. "It is?" he said. "What bag?"

"And what is a cat?" said Max, his stalks similarly crossed.

Roger laughed. "It's an AngloTerran saying. It means you have nothing more to lose by telling us."

Max turned his stalks toward Ingvrau. "Counsel me, Ingvrau. What should I do?"

"We might as well tell them." Ingvrau cast a glance at Duncan. "Then we can plead that they keep the secret."

"It is our only choice," said Max. He stood and tromped to the door. "But first I will bring Nriln translators down here for our guests. There is no need for them to put up with those *vishnel zhorghanor* Delvan devices anymore." Max opened the door, then swiveled his eyestalks around to look at Roger and Duncan. "I will be back maximally minus three soon." He sped out the door.

Roger, Duncan and Ingvrau stood star-

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ing awkwardly at each other. Without Max, there really wasn't much to talk about.

"Um. Interesting weather we're having here on Delva," said Roger.

"It is so-so in the cold-hot domain," said Ingvrau, "for this time of year."

"That's interesting," said Duncan, his voice showing an extreme lack of interest.

Max burst back into the room. In his six-fingered hands, he held what looked like two Delvan-translators. "Turn off those *zhorghanor* Delvan disasters." Max handed the AngloTerrans each a translator. "Ours," he said, "but in Delvan-translator cases."

While Max walked over to a chair, Duncan and Roger switched them on and popped the buds into their ears.

"I've preset them to AngloTerran," said Max. "I'm inclined to think you'll find the translations quite acceptable now."

"I say, chaps," said Ingvrau, "This is indeed rather better, yes?"

"Yes," said Roger, softly, dazed by Ingvrau's new accent.

"Yes, indeed," said Duncan.

"Very good, then." Max sat and indicated the others do the same. "Now, I expect, we can hold a reasonable conversation. It's much better without those damn blasted Delvan atrocities."

Roger and Duncan nodded.

"To answer your question." said Max, "The Delvans demanded of us that their language be used as the intermediate language for the translators."

"But," said Roger, "why didn't you make the translators interpret nose-tones? It's your language, after all."

"We didn't think it appropriate to have the emotional content of our words translated," said Max. "And in any case, the Delvans didn't particularly desire it either."

"No," said Roger. "I mean the leaving out of the numeric adjective modifiers."

"We do that, do we?" said Ingvrau.

"Hmm. Perhaps we do, at times," said Max. "I hadn't really thought about it."

Duncan laughed. "But still, you spoke to us using those tones that we couldn't understand."

"Dear boy," said Ingvrau. "We weren't about to let the Delvans tell us how to speak our language."

"I'm surprised you had anything to do with them at all," said Roger.

"The Delvans are superb traders and are good at packaging." Max dropped his eyestalks. His distress was easy to see. "And they negotiate fiercely." He sighed. "I'm exceedingly worried. Our home planet can scarcely afford the loss of the Delvan contract monies, not to mention the penalty we're subject to for revealing the secret."

Roger was struck with an idea. He started to raise his hand, but stopped in time. "But interstellar law always allows you to confide in your lawyers."

Duncan looked at him, quizzically.

"I'm sorry, old chap," said Ingvrau. "But I'm not entirely sure what you're driving at."

"There's nothing that says your contract lawyers must be Nriln," said Roger. He glanced over at Duncan and saw the light of comprehension in his expression—and also a look of admiring approval. Roger smiled.

"My colleague is correct," said Duncan. "And while *your* planetary specialty is cultural studies, ours is litigation." He straightened his tie. "I, by the way, happen to be a contract lawyer—an AngloTerran requirement for a trade ambassador. I offer my services."

"Except," said Roger, "there's that little matter of the duel. I hope my apology will suffice and you'll forgo the bashing with sticks." Listening to himself speak, Roger felt embarrassed. He had affected the English accent that the Nriln had chosen for their translators.

Max, ignoring Roger, kept his eyes on Duncan. "Do you really think you can find us a, shall we say, loophole in the Delvan contract?"

"Most likely," said Duncan. "How

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soon could I have an English language translation of it?"

"Immediately." Max spoke into his wrist-communicator, then looked up. "Done. It's waiting for us in the conference room."

"That was quick," said Roger.

"It's rather our specialty," said Max. "Oh. And apology accepted. I withdraw my challenge to a duel." He narrowed his eyestalks and peered at Roger. "Friends, yes?"

"Yes," said Roger.

In the conference room, Duncan pored over the contract. Vurzh and Ingvrau sat at the table across from Duncan while Max and Roger peered over Duncan's shoulder.

"What do you think?" said Roger.

"It says the Nriln can't license or sell the technology to any other culture and there's a non-compete clause; The Nriln can't build and sell translators." Duncan pushed away the contract and sighed. "It looks pretty solid."

"Oh dear," said Max. "We were afraid of that."

"Wait!" Roger bounded to his feet. "Listen. Is there any reason the Nriln couldn't just give the technology away? To us, for example."

Duncan laughed. "Well, yes. I guess they could do that. But other than for spite, I can't see why they'd want to."

"Nor can I," said Max. "As enjoyable as it might be, old chap, we do indeed need the revenue."

"Oh, I don't know," said Roger. "Maybe you might just do it to say 'thank you' to a group that contracts to buy all the yttrium you can produce—at a sale price of say, twenty times the going market rate."

"Roger," said Duncan. "You're good at this."

Roger, warmed by the rare compliment, smiled, and then continued. "And of course we might get you a research grant to create translators for all languages without having to use an intermediary language—especially Delvan."

"Jolly good show," said Max. "But is this in your power to deliver?"

Roger turned to his colleague.

"Yes," said Duncan. "My government has granted me wide powers in matters of trade." He smiled. "But do *you* have the authority?"

"Quite," said Max.

"Fine." Duncan leaned back in his chair. "Let's draw up an agreement."

"One moment," said Vurzh. "This seems a trifle dodgy to me—a bit of a sticky wicket, if you know what I mean."

"What?" said Roger.

"I'm not sure I *do* know what you mean," said Duncan.

"I was just wondering," said Vurzh. "Would this scheme hold up under the scrutiny of the Panstellar Trade Court?"

"Oh, I think so." Duncan shrugged. "The Delvans will appeal, of course, and the litigation and counterlitigation could go on for generations. But by then, it won't matter." He smiled. "But if the court rules against *us*, then we'll appeal."

Max narrowed his stalks. "Splendid. I'm quite satisfied. Let's do indeed draw up our little agreement."

"But first." Vurzh stood and stepped back from the table. "As it is our tradition, we must first sing some oratory."

Max and Ingvrau moved to stand beside Vurzh, and the three of them began their rite of custom.

Even though, using the Nriln translators, Roger understood the commentary, he still grimaced. With all the shrieking and squealing, it sounded like a bagpipe band had fallen into a cement mixer. He opened his mouth to speak, but Duncan kicked his ankle.

"Don't say it," said Duncan, softly. "Don't say a word. And for God sake's, keep your hands in your pockets." Then he added, "And good work, by the way." ■

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Special Feature

RULES OF ENGINEERING PROJECTS

Geoffrey A. Landis

These may not be as rigorous as Newton's laws or Maxwell's equations, but they're just as important!

Projects that fail . . . and succeed

From Murphy's law (and its numerous corollaries) on through the Peter Principle, pundits have come up with hundreds of laws and rules to explain science and engineering. (Feynmann's rule: Never trust the data point furthest to the right*. Scotty's law: When the engines are overloaded and just can't take any more, they can always take just a wee bit more if the captain really needs them to.) Many of them are more humorous than realistic (despite sophisticated mathematical analysis, toast doesn't in fact always fall butter-side down. It's just that we don't remember the times when it doesn't make a mess.)

I've been working in science and engineering for a little over twenty-five years now; I've seen a few projects fly and a lot of projects fail. I've noticed that most projects end in a way that is neither spectacular nor even conclusive. If things failed by blowing up, at least you'd get some excitement, maybe even some fire and smoke. But most projects fail with a whisper, not a bang.

It may be true that in theory, even a failure is a result, but in the real world, most failures aren't obliging enough to be clear-cut and unambiguous—much more often, something doesn't work and you never really know why. In science fiction, an anomalous result in the lab means you've found some new science. In real physics, I've discovered, an anomalous result usually means an instrument error. (When in doubt, calibrate. Then calibrate again.)

The most typical project end, in fact, is a management failure—often one that happened years earlier: a project that has sputtered on for years after it's failed to achieve either a real success or a clear-cut failure finally just runs out of energy.

Still, I've seen a lot of projects fail sim-

*Feynmann's observation: The experimenters certainly would have gotten a point even further to the right if they could have done so, right? So the last point is always right at the edge of what's possible—and hence suspect.

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ply from a lack of the combination of observation and experience that goes by the name of "common sense." So here are my observations: the laws of engineering, experimental science, and project management in the real world.

Geoffrey's Laws of Engineering

1. The devil is in the details.

2. The best engineering material is paper: a design on paper always performs better than the one you actually have to build.

3. Starting projects is easy. *Finishing* projects is hard.

4. In engineering, you can never ignore the laws of physics. In human endeavors, you can never ignore the laws of economics.

5. All failures are obvious in hindsight.

6. Failure is a milestone on the road to success.

7. Real advances are achieved by evolution, not revolution.

8. Design for the possibility that moving parts don't.

9. Every system designed to prevent a particular failure introduces a new mode of failure.

10. Never get rid of the old computer system until you have the new system up and running.

11. Engineering design consists of trade-offs. If you only see the advantages of your approach and not the disadvantages, you don't understand the problem.

12. The least important design constraint always ends up driving the design.

13. Program managers are the most conservative people in the world; they will never fly a new technology if it is possible to accomplish the mission without it.

14. Plagiarism is good engineering.

15. Progress is made when a project is invisible. With publicity comes management attention, and every engineering decision is subject to second-guessing.

16. To get where you're going, you have to start where you are.

17. Competition may be inefficient, but it's a lot more efficient than no competition.

18. Technology diffuses.

19. Technologies that succeed are built on the corpses of hundreds of ideas that sounded just as good, but failed.

20. Figures don't lie, but liars figure. Put your faith in numbers—but only when you've done the numbers yourself, and verified the assumptions.

Corrolaries

Some of these deserve a bit of elaboration, so here are a corresponding 20 corrolaries to the laws of engineering projects.

1. Lots of designs look good on paper, and you don't see the real problems until you get into the details.

2. Designs that have never been built in the real world don't have real-world problems. Just because somebody proposes a great design, and tells you how great it is, doesn't mean that it will be great in the real world. See rule #1!

4. If it can't make money, it won't fly. Advocates will always project the most optimistic economic scenario; you should view them with a jaundiced eye. Most economic projections are lies.

5. When something fails, everybody in the world will jump up and say that they knew right from the beginning it was a bad idea. (Same with successes, for that matter.)

6. Since failures are milestones on the road to success, and all failures are obvious in hindsight, to succeed you have to accept that you are going to make "obvious" errors.

7. Everybody wants the breakthrough, but nobody ever wants to accept slow, step-by-step progress. Don't expect the first design to achieve a breakthrough in performance. First get it to work, then work on improving it.

8. Every moving part is a potential point of failure. It's good engineering de-

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sign to minimize, or eliminate, moving parts. (An automobile may indeed have a thousand different moving parts, but keep in mind that this is the end result of over a century of design evolution—and autos still break down.)

10. Mary's corrolary: Keep the old computer for at least a year after you have the new one running, too.

11. This applies to other aspects of life as well.

12. If a design constraint isn't important to the design, dump it.

13. The best way to get a new technology flown is to make it look exactly like an old technology.

14. Real engineers never design something new if they can simply copy an existing design that works. Think of it as evolution in action.

15. And often third-guessing, fourth-guessing and fifth-guessing, too. To quote Bill Yerkes: "Work underground as long as possible—publicity triggers the corporate immune system."

16. It doesn't matter what we "should have" done twenty years ago. Where can we go from where we are now?

17. It's amazing how much improvement you get when everybody knows that they'll lose their jobs if they can't beat the other guy. Except in Congress, where competition is known as "wasteful duplication of effort."

18. An innovation that works in one design will find applications to everything else. And sometimes an innovation that doesn't work in one design will find application to somewhere else.

19. Anybody remember fluidic logic? Bubble memory? Cuprous-oxide solar cells? The Tesla bladeless turbine?

20. And remember that the devil is in the details.

Geoffrey's Three Laws of Robotics

Robotics, too, is a form of engineering. Asimov, alas, got it wrong: his three laws of robotics, as it turns out, have nothing to do with the way real-world robots or artificial-intelligence systems behave.

To update the laws of robotics, I wrote down the three laws of robotics and computers they way they work in the engineering world.

First Law: A robot will do what it's instructed to do, no more and no less.

Second Law: The language in which instructions are given to the robot is designed to be convenient to the robot, not you.

Third Law: All consequences of the robot's actions are the responsibility of the programmer, not the robot. The robot doesn't know, or care, about consequences.

These three laws have certain corollaries:

Corollaries to the first law:

1. It doesn't care what you thought you said.

2. The way in which the robot interprets instructions is up to the robot, not up to you.

Corollaries to the second law:

1. Robots don't understand English.

2. If robots simulate understanding English, the English they understand is not the same as the English you speak.

3. If the language seems to be clear and straightforward to you, this is an illusion.

4. No matter how well-documented the language, some commands are always undocumented.

5. The undocumented commands always include "halt and catch fire."

Corollaries to the third law:

1. Causing harm to a human, or through inaction causing a human to come to harm, is of no concern to the robot.

2. It doesn't care about whether it causes harm to itself, either.

3. Those "keep out" zones are there for a reason.

4. Artificial intelligence isn't.

So there you have it. If you want to build some robots, or succeed in engineering—or in life—here are some simple rules to keep in mind. ■

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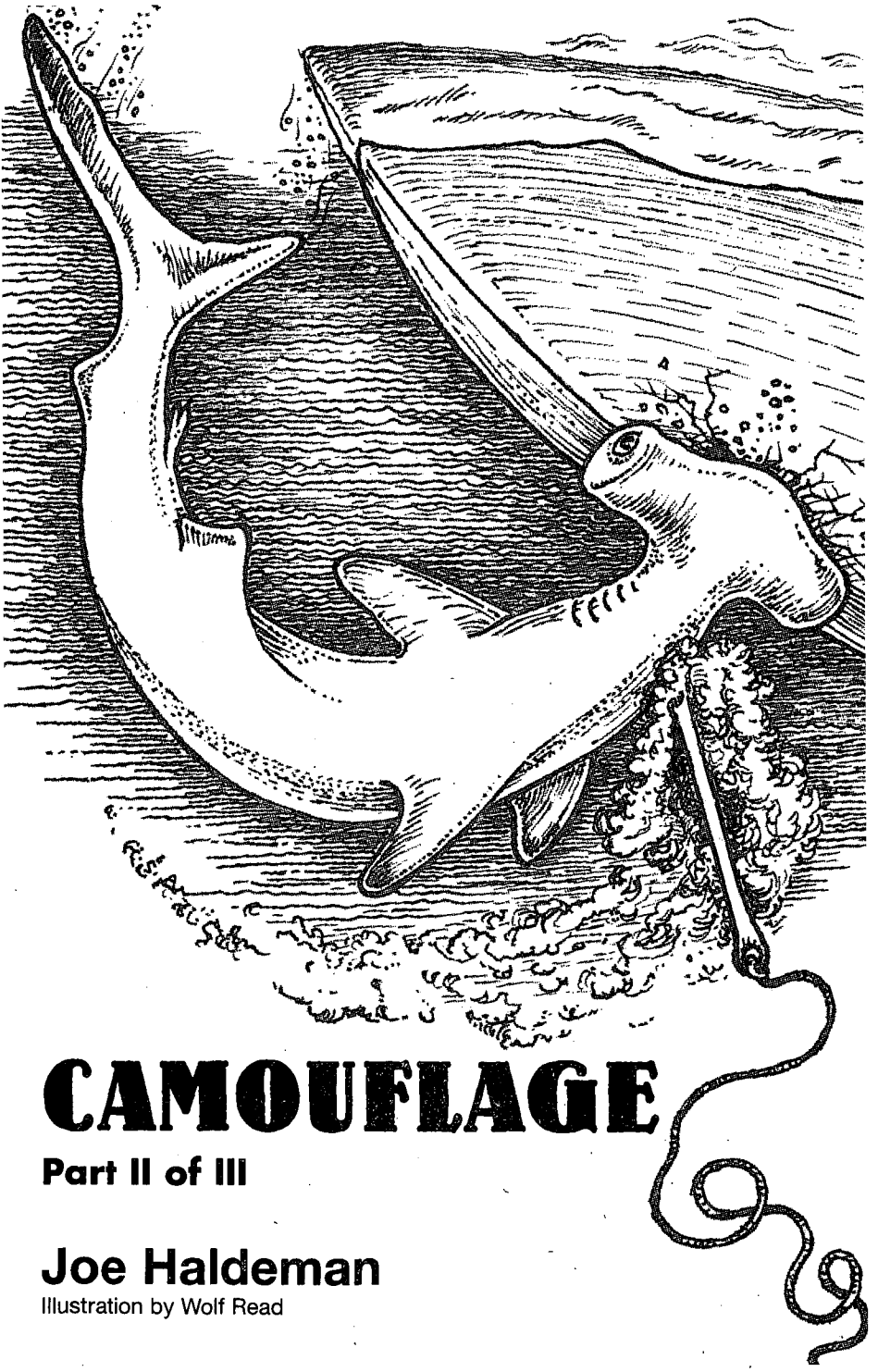

CAMOUFLAGE

Part II of III

Joe Haldeman

Illustration by Wolf Read

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Can "this town ain't big enough for the both of us" apply to a whole planet?

This story contains scenes that may be disturbing to some readers

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What has gone before—

Part 1

In 2019, an artifact from outer space is hauled up from a deep Pacific trench, from underneath fossil coral a million years old. A private research team, headed by Russell Sutton in an uneasy collaboration with shady millionaire Jack Halliburton, has claimed salvage rights and set up shop on Apia, Independent Samoa, far from the American government's prying eyes. They don't know what the thing is, but if they can crack its secrets, it should mean billions of Eurobucks.

Smaller than a delivery van, the streamlined metal mystery weighs more than a Polaris-class submarine. An industrial diamond drill won't mark it; no solvent or torch can even blemish its perfect mirror surface.

The thing it brought to Earth, called ***the changeling****, has spent most of its life as a sea creature. With some difficulty and pain, it can make itself look like anything. It doesn't remember the artifact, or indeed much of its past million years of life.*

*Unbeknownst to the changeling, the Earth harbors another extraterrestrial creature, unrelated, that shares some of its powers—****the chameleon****, able to look like any male human, but with a propensity for looking large and mean.*

In 1931, the changeling tries on a human body for the first time, and gets into a lot of trouble, but eventually decides it's more interesting than being a grouper or a shark. It tries various identities and decides to become a scientist.

In 1941, the changeling joins the U.S. Marines and goes to fight in the Pacific. It winds up dying several times and experiencing the horrific stress of the Bataan Death March.

21. Apia, Samoa—24 Dec 2020

Everybody wanted to be "there" when the laser was first used, but of course there wasn't room in the lab itself, which for this phase of the research didn't look much like a lab. The laser was basically a government-gray metal box the size of a pick-up truck, squatting in the jury-rigged extension they'd welded on to the environmental containment vessel. Its barrel, a glass cylinder, was aligned with the taped-off 4"x4" square on the artifact's side, looking up at about a thirty-degree angle. In the ceiling was an oval of optical glass that should be perfectly transparent to the laser's frequency. Better be.

The entrance side of the lab had been turned into a bunker, steel plate fronting concrete blocks. Three technicians were crowded in there, scrutinizing data feeds and watching the experiment over a video monitor.

Everybody else was watching a widescreen monitor in fala #7, which was also crowded, with twenty-one people standing or sitting, attention riveted on the screen.

"Sixty seconds," the screen said, unnecessarily, the digital count-down rolling away in the lower right-hand corner.

Jan was seated between Russ and Jack, front row center. "Now we'll see," she said.

"Won't see a damn thing," Jack said.

"Bet you a beer," Russ said.

"On a measurable physical change? You're on."

Nobody said anything more as the count-down rolled to zero. Then the laser hummed, and there was a pale visible ray between the barrel and the target area, as its ferocious power ionized the air. The tape vanished in a puff of smoke.

Nothing obvious was happening to the artifact. "Should've held out for an imported beer," Jack said.

"Temperature's up," a technician said from the screen. "All over the artifact. Every sensor shows about a degree Celsius increase."

"I'll take a Valima," Russ said.

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"How about the ambient temperature?" Jack asked the screen.

"Also up a degree, Dr. Halliburton. To twenty-one degrees."

"So no deal. It always matches the ambient temperature."

"Quibble, quibble," Russ said. "Still a measurable physical change."

"I think you should split a beer," Jan said, "and play nice."

Jack nodded absently. "Try full power?"

"Twenty percent," Russ said quickly. "We don't want full power with air in the room."

"Okay. Naomi," he said to the screen, "let's crank the laser up to 20 percent."

"Done." There was no visible change. After a minute she said, "Temperature's up another degree."

"Let's turn it off and examine the artifact," Russ said.

Jack was staring at the spot where the laser was concentrating enough power to melt through thick steel, hoping for a wisp of smoke, anything. "Oh . . . all right."

Naomi and Moishe Rosse, Jan's senior technician, went from the bunker into the slightly less confined "artifact room." They spent a couple of hours sending data back to the people in #7: visual, electron, and positron. The air in the room showed an unsurprising increase in ozone and oxides of nitrogen.

Nothing had changed.

"Let's go ahead and evacuate the room," Russ said, "and repeat the 10 and 20 percent exposures. With no air in the room, any temperature increase in the artifact is going to be straight radiative transfer from the laser."

"We ought to crank it up to 50 percent," Jack said.

"If there's no change." Russ looked at Jan. "Okay?"

She nodded. "How long to evacuate the room?"

Greg Fulvia spoke up. "We figure about six hours to zero-point-one millibar."

"We ought to check the laser periodically as the pressure goes down," Moishe said from the screen. "It's designed to work in a vacuum, but that's after sitting in orbit for a long time."

"What do you expect?" Russ asked.

"I don't know. I expect machines to malfunction when you change their operating environment."

"Do a system check every hour or so, then," Jack said. "The sensors, too, and microscopes. The positron's kind of a delicate puppy."

Russ looked at his watch; it was almost noon. "Let's all be back here at 1700. Who do you need, Greg?"

"It's all set up. I'll flick the switch and Tom and I can take turns looking at the nanometer." He talked to the screen. "You guys let us know when you're battened down." Moishe said to give them ten minutes.

"Sails?" Russ said, a restaurant on the harbor. He and Jan rode bicycles over, and got drenched in a one-minute downpour. Jack was waiting for them at a balcony table.

"Nice cab ride?" Jan asked, rubbing a bandana through her ruff of white hair.

"Bumpy as hell." He pushed a bottle of red wine an inch in their direction. "I took the liberty."

"A glass, anyhow." She poured for herself and Russ, and they sat down heavily, simultaneously. "Not a cloud in the sky."

"Bicycling causes rain," Jack said. "Scientific fact."

"Glad there's some science today," Russ said. The waiter came up and they all ordered without looking at the menu.

"You shouldn't complain," Jack said. "You got what you wanted."

"Expected," he said. "What I *want* is for a little door to open and an alien to slither out and tell us to turn down the heat." He saw Jan's look. "Honest. You've converted me."

"Every time we stress it without leaving a mark is a point for my side." She took a sip. "It's our technology versus theirs, or what theirs was a million years ago."

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"And where are they now?" Russ said. "Either dead and gone or on their way home."

"Or they were us a million years ago," Jack said. "You read the *Times* thing yesterday?"

"Lori Timms," Russ said without inflection. She was a popular science writer.

"What was it?" Jan said.

"Just a new angle on the time capsule theory," Russ said. "She thinks our ancestors deliberately renounced technology, and carefully wiped out every trace of their civilization. Except the artifact, which they left as a warning, in case their descendants, us, started on their path as well.

"She handles the problem of the fossil record by postulating that they were as knowledgeable in life sciences as in the physical ones. They repopulated the world with appropriate creatures."

Russ laughed. "And then what did they do with the fossil record that was already there? Carbon dating doesn't lie."

"Maybe they cleaned 'em up. Had some way to find all the fossils and get rid of 'em."

"That's a bit of a stretch."

"Well, think about it," Jan said. "What if the 'million-year-old' part is wrong? What if *that* part of it was faked? Any technology that could build the artifact could bury it under an ancient coral reef. Then you only have to worry about archeology."

"And the historical record," Russ said.

"'There were giants on the earth in those days,'" Jan said, smiling.

"And fishburgers now," Jack said, as the waiter came through the door.

22. Bataan, P.I.—5 April 1942

The changeling waited until two groups of marchers had gone by, and there was no sound of nearby movement. It knew that the loose dirt of its grave would move around while it went through the hour of agony it took to change from one body to another.

It planned to leave the head behind, and become a foot shorter. Japanese.

"Agony" is really too human a word to describe what it went through. It was tearing its body apart and reassembling it from the center outwards, squeezing and ripping organs, crushing bones and forcing them to knife through flesh, but pain was just another sense to it, not a signal to modify its behavior. Besides, it was nothing new. It had been hundreds of people by now.

When it had become a Japanese private, complete with grimy uniform, it pushed up in a shower of dirt, to its knees, and then stood and brushed itself off. As it had calculated, the sun was well down, and it was pitch black.

Except for the flashlight.

Someone screamed and ran away. The changeling was at first impeded by the loose dirt, but then it sprang out, and in three long steps caught up with the fleeing intruder and pushed him lightly to the ground.

He was a Filipino child, cowering in terror, still clutching a canvas bag. Six or seven years old.

The changeling sorted through the few Japanese phrases it had accumulated, and decided none was appropriate. It used English: "Don't be afraid. I was just resting. We do it that way. It's cool in the dirt."

The boy probably didn't understand a word, but the tone of the changeling's voice calmed him. It helped him to his feet and handed him flashlight and bag, and made a shoo-ing motion. "Now go! Get out of here!" The boy ran wildly away.

Perhaps it should have killed him. With a finger punch it could have simulated a bullet wound to the head. But what could he really do? He would run home and tell his parents, and they would interpret the event in terms of what they knew of reality, and be glad the boy had survived waking up a Japanese soldier. He would tell the other children, and they might believe him, but other adults would dismiss it as imagination.

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(In fact, the changeling was wrong. The boy's parents *did* believe he had awakened a dead man, and told him to be quiet about it except to God, and pray thankfulness for the rest of his life, that God had chosen to spare him.)

The changeling widened its irises temporarily, so the starlit desolation was as bright as day, and started moving quietly but swiftly north. It took only a half hour to catch up with a group that had been allowed a few hours of rest. It had passed four Americans lying dead in the road.

It saw only one guard awake, leaning against the fender of a truck. It went behind the truck and forced itself to produce urine, and then casually walked forward, adjusting its clothes. "*Hai*," it whispered to the guard, ready to kill him instantly if his reaction was wrong. He just grunted and spit.

It walked among the Americans, planning. The masquerade as a Japanese probably wouldn't pass muster during the day, among Japanese. So it would be best to change back into an American before dawn.

By starlight it examined every sleeping face. None of them was familiar, either from the Marine detachment or from the Marivreles camp. So it could become Jimmy again, and not have to fake a new history.

The people at the end of the group would be the ones nearest death, and probably least likely to be keeping track of who was around them. In fact, it found two that were dead, and quietly lay down between them in the pitch darkness.

It made as little noise as possible, changing the bones of its face back into Jimmy's starveling countenance. The uniform was trivially easy, and only made a normal rustling sound. It stretched the Japanese skeleton as much as was practical, with an occasional popped-knuckle noise, and got to within three inches of Jimmy's height.

What it wound up with was an even more famished version of Jimmy, which was fine. The weaker-looking, the better.

With the first light of dawn, the Japanese guards were working through their ranks, shouting and kicking. A sudden blue flash and rifle shot got them moving faster.

They left five behind, dead or so close as to make no difference. The sun sped up over the horizon, and in less than an hour, the morning cool had dissipated.

It had rained torrentially two days before, and although the road was dry and dusty, there were sometimes mud puddles at the edge of the fields. People would fall out of ranks to go to them with their canteen, but the guards would chase them off.

Finally there was a huge puddle, a wallow where two water buffalo were cooling off. The water was green and odiferous, but there was lots of it, and a guard who was a private made an ironic gesture inviting them over.

A man next to the changeling put his hand on its shoulder. "Wait," he croaked. "That's the asshole got us fucked with yesterday."

Dozens of men staggered to the wallow and pushed the scum aside to drink and fill canteens or cups. Some splashed water over their heads and chests, cooling off like the buffalo, which would prove a mistake.

An officer with a saber came running down the line screaming at the ones in the water. They hustled back to rejoin the ranks.

The officer huddled the guards and then watched smiling while they moved through the crowd and pulled out everyone with damp clothing.

They lined them up along the side of the road. The officer said one word and in a ragged volley they shot them all.

In the ringing silence after the shots, the man next to the changeling said, "Shitty water woulda killed 'em anyhow."

The changeling nodded and, with the

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others, began shuffling away from the execution scene. It was having difficulty trying to generalize about human nature.

Would Americans have done that, with the roles reversed? It seemed inconsistent with what it had observed, except occasionally at the insane asylum, where there were patients unable to see others as human beings. Perhaps it was the stress of combat, but the Japanese after all had won, against very little resistance.

That might be it: since the Americans had surrendered, the militant Japanese felt they didn't deserve human treatment.

After the war, it would have to look into this. That wouldn't be very hard, since apparently the Japanese were going to win, and everyone would have to learn their language, and be assimilated into their culture.

Unless they slaughtered all the Americans like animals, as it had just witnessed. Well, it could become a Japanese who'd lost the power of speech. That had worked before.

They finally got to Balanga, the first town on their route of march. Filipinos lined the road, staring at the Americans, and began throwing food to them—sticks of sugar cane, rice balls, sugar cakes—until suddenly the Japanese started shooting.

The civilians scattered, running for cover. Two young men took off across a field, which apparently caught someone's attention. Three of the guards, clustered together, started firing at them, laughing. They kept missing them, either on purpose or from poor marksmanship, but they finally fell.

The three went out to inspect their handiwork, and evidently the two boys were still alive. They kicked them around and yelled at them, and finally shot them several times point-blank.

Most of the men watched this tableau in shocked silence. Someone behind the changeling growled "fucking Jap bastards," and someone else shushed him.

The changeling tried to interpret what was happening in terms of animal and human behavior, and the little it knew about Japanese culture. If they were trying to scare the Americans with a show of brutality, it wasn't working well; the ones susceptible to that were already nearly paralyzed with terror. Most of the prisoners by now assumed they were going to die, and were just concentrating on not being next. Each fresh horror seemed to increase the men's contempt for the Japanese "animals," (as if non-human animals ever behaved in such elaborate ways) and also increased their dissatisfaction with their own command, who had surrendered them. Though their defense of Bataan would have been unimpressive, without food, water, gasoline, or ammunition.

The Japanese behavior revealed vicious contempt, as if the individual Americans had decided to throw down their arms rather than fight. That was an understandable simplification, for young men so unsophisticated they evidently still thought, after all these days, that the Americans would understand Japanese if they spoke it loudly enough.

The gulf between the two sides was so large it was as if they were two different species. The changeling wished it had had an opportunity to observe other cultures than American without the complication of war. It resolved to do that when the war was over.

The Japanese marched them into the middle of town, into a dark hot warehouse building. It was already crowded with prisoners, but the guards pushed them in tighter and tighter, until it was literally impossible to sit or lie down; the men were packed like sardines in a can.

They smelled worse than sardines, though, with no toilet other than their own clothing. The guards evidently couldn't stand it after a half hour. They padlocked the door and stood guard outside, while their charges steeped in their own excrement. Many or most of them

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had some degree of dysentery, and had lost control of their bowel function. Urine baked on skin and the rags of uniforms, and if someone fainted from the stench, or died, he remained standing, just another sardine.

The changeling was near the padlocked door, and knew it could break it down with little effort. That would probably earn a few people a minute of fresh air before they were shot. If the men had been in a position to vote, they probably would have said "go for it."

But it was content to wait and watch, the miasma no more or less pleasant than the sea breeze outside. People stopped talking and concentrated on living another minute, hour, day.

In the morning, the Japanese opened the door and the prisoners staggered or crawled out into the sudden light, leaving twenty-five dead behind. They were beaten into line and fed a small rice ball and a little tepid tea before getting back on the road, which was already shimmering with heat.

Even with its superhuman metabolism, the changeling had lost five kilograms by the end of the march, on the morning of 15 April, at the San Fernando railway station.

The Japanese kicked and shouted the men awake and herded them into narrow-gauge boxcars, more than a hundred men per car. It was like a reprise of Balanga, packed shoulder to shoulder, with the added factor of the train's queasy rocking motion. A few people near the doors had actual air to breathe; the others had to make do with a hot stale atmosphere combining shit, piss, and vomit with carbon dioxide and dust.

One hundred and fifteen had been packed into the changeling's car. When they stumbled out five hours later, they left behind four corpses.

They were made to sit motionless in the hot sun at Capiz Tarlac for three hours, and then were marched across town to their final destination, Camp O'Donnell. There they confronted a nightmare several orders of magnitude larger than the march itself: 12,000 prisoners were confined to a square of baking concrete one hundred yards on a side.

Most of the thousands of Americans and Filipinos were standing in a slow line waiting for the one water spigot. The old hands told them that it usually took about six hours—sometimes ten or twelve—to get to the spigot and fill your canteen. So after you fill it, you might as well just go back to the end of the line.

They were supposedly going to get food tomorrow. But the Japanese had been saying that for three days.

The changeling got into line, even though if it wanted water it could assimilate it directly from the air, or even break down carbohydrates for it. As the line inched along, the prisoners walking back toward the end would scrutinize faces, trying to identify old comrades through the mask of filth and exhaustion.

The inevitable happened. "Jimmy? My God—Jimmy?"

The changeling looked up. "Hugh."

"You're alive," he said.

"Just barely," the changeling said. "You, too."

"No! I mean . . . I mean . . . I saw you get your head chopped off! After you pulled the Jap off the truck."

"Must have been someone who looked like me."

One of the Japanese guards stepped over and seized Hugh by the shoulder. "Repeat what you just said," he said in almost perfect English.

Hugh cringed. "Thought he looked like somebody."

"Repeat!" The soldier shook him. "The truck!"

"He—he looked like someone who pulled a guard off a truck. But he's someone else."

The guard shoved Hugh away and clamped on to the changeling's shoulder and stared. "I buried you. I saw your face

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in the hole, looking up."

The changeling thought back and realized that he indeed was one of the guards on that detail. "Then how am I alive now?"

The man continued staring, the blood draining out of his face. Then he jerked the changeling out of the line and shoved him through the crowd toward a line of white buildings.

"Sit!" He pushed the changeling down on a step and shouted something in Japanese. Two young soldiers in clean uniforms scurried over to point their rifles at the changeling's head. It considered doing something to make them shoot, and simplify the situation by apparently dying. But it was curious.

The guard returned with another familiar face: the officer who had performed the execution.

He studied the changeling and laughed. "Do you have a twin?"

"They say everyone does, somewhere."

He stepped forward and fingered what was left of the insignia on Jimmy's uniform. "Not in the same Marine detachment, I think."

He said something in Japanese and the two soldiers prodded the changeling to its feet. "We'll see about you," the officer said. "What is your name?"

"Private First Class William Harrison, sir," it said, and made up a random serial number. The officer wrote it down painstakingly and barked an order at the privates. "Tomorrow," he added. By tomorrow, the changeling decided, it would be someone and somewhere else.

The privates pushed their prisoner through the door and down a dark corridor. A Filipino jailer, closely observed by a Japanese officer, unlocked a door of heavy iron bars. The changeling quickly memorized both of their faces. A basic plan would be to break out physically and kill one or both of them, and walk out as the officer's doppelganger.

The Filipino took the changeling to the last of six cells and locked the old cast iron barred door. The changeling widened its irises in the darkness and memorized the shape of the key.

As the guard walked away, a hoarse voice in the adjacent cell asked, "What they get you for?"

"They haven't said. You?"

"Stole a can of sardines. Say they're going to let me starve."

"We're starving outside anyhow," the changeling said. "At least this is out of the sun."

The key rattled in the door and the Filipino let the Japanese officer in. He had a riding crop, and whipped the changeling's face and shoulders. "You quiet!" The changeling heard him do the same next door.

The cell had a board for a bed and a bucket for a toilet. The bucket was foul and buzzing with flies; maggots quietly rustled inside. There was a small open window about six inches square, up near the ceiling. Only a little light came through. It faced north and was evidently in the shadow of an eave.

The man who was sobbing next door was the only other prisoner who was conscious. The changeling could hear one near the jailer's station whose breath was so shallow and ragged he must be near death.

It could easily make itself slender enough to slip between the bars. It was also strong enough to bend the bars and widen that space, but that would make noise, and leave behind evidence of a prisoner who was not human. There was already too much curiosity about "William Harrison." Best to find a way to simply vanish. That could be explained away as bribery or carelessness.

There was a drain in the floor that would probably lead to a river. But it was only an inch in diameter. To form a shape that could slip through that would take hours; to keep enough mass to re-form into human shape would require a worm about a hundred feet long, and while it was turning into that

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grotesque creature, it would be conspicuous and vulnerable.

That gave it an idea, though. It heard the Japanese guard leave, and within an hour the Filipino was snoring.

It removed its right leg, with a sound like someone softly cracking his knuckles, then tearing clothes quietly. That drew no attention. The leg reformed itself into a defensive creature that looked like a pile of rags but had teeth and claws like a sabretooth tiger's.

The changeling began to reform, not into a worm, but into a snake about the size and shape of a young reticulated python. It had a square cross-section slightly smaller than the high small window.

That took about an hour of vulnerability. It was the work of a minute, then, to merge with the sabretooth section, which was also six inches in thickness.

It had hundreds of gecko-like legs, so scrabbling up the wall was easy. It extended an eye through the opening and saw no one, though there were bright lights to the east. To the west there was a drainage ditch.

It slithered through the opening and down the wall, changing its color to match the dusty pink of the building. It stretched out along the length of the wall, as it had seen snakes do, and peered around the corner.

So far so good. To its right was the large square where the prisoners sleepily stepped along the undulating line to the water tap. There were plenty of guards, but they were standing or sitting with their backs to the drainage ditch.

Decisions. It would take too long to change back into a human form, and besides, the snake would probably be more efficient once in the water, assuming the ditch wasn't dry. If it were intercepted on the way . . . that would be awkward. It was a cross between a boa constrictor and a chainsaw, so there would be no question about the outcome of an encounter between it and one or several humans. But it would have more than ten thousand witnesses.

It looked around and thought. Electricity.

The power line that served the jail building went on to the prisoners' square. Seeing no potential witnesses, it slid up the wall and took one huge bite. Delicious taste of copper, dusty glass, and high voltage, and everything near went dark.

There were shouts and firing into the air, and then flashlight beams lancing, but all of the attention was directed inward, toward the prisoners. The changeling dropped to the ground and scurried on a thousand lizard legs to the ditch. Slid in and found a few inches of sewage, and slithered south.

It remembered from ordnance maps at the Bataan base that Manila Bay was about forty kilometers south, and there were plenty of rivers through the Panga and Bulacan provinces. Once in Manila Bay, it was about sixty kilometers around the Bataan peninsula to the South China Sea.

In the six hours that it took to get to the bay, there was only one witness, to its knowledge: a drunken man on a narrow wooden bridge. He screamed and fled. If anyone came out into the night to check his preposterous story, the changeling would be long gone.

Dawn was still hours away when the final ditch widened into a mud flat and the changeling wormed its way into the bay. It dove down to the bottom and began the process of changing into a fish.

A shark bit it in two, which was annoying. But it evidently didn't like the flavor, and left the two halves alone. The changeling crawled along the bottom, crunching up bivalves and crabs and when it had enough mass, it took the familiar shape of a great white shark itself. By then it was in the South China Sea. It pointed itself east. Only ten thousand miles to California.

23. Apia, Samoa—
24 December 2020

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The evacuation of the artifact room had taken a little longer than expected, but there were no leaks, and all of the data-gathering equipment seemed to be working fine. At 17:30, Naomi said through the monitor, "Okay. We can start the countdown."

Jack nodded. "Fire when ready, Gridley." No one else in the room knew who Gridley was.

After a few minutes, there was no temperature change at 10 percent. Naomi increased it to twenty, and then to thirty.

"Go to fifty," Jack said, and Russ and Jan nodded.

"Where's it all going?" Jan muttered, a question they'd all asked before. At least when there was air in the building, some of the energy had gone into heating the air. Now, the laser was putting out enough energy to run a small city into a hundred-square-centimeter area, and it was all disappearing—into the artifact, apparently.

"Go to a hundred?" Jack said.

"Seventy-five," Russ and Jan said simultaneously.

It never got there. The monitor went blank and second later the people in Cottage 7 heard the dull thump of an explosion.

Jan and Russ were the first ones there, with their bicycles. Half the building had collapsed, the big laser almost submerged in the water. Naomi and Moishe were staggering out of the water, coughing and gagging.

Russ took Naomi's arm. "Are you all right?"

She ignored the question, and stared back at the wreck of the lab. "It moved."

"Moved?" Russ said.

"Floated up and crashed down."

"Holy shit."

"Merry Christmas."

Most of the equipment was wrecked, but a high-speed camera, which the manufacturer called "ruggedized," had been rugged enough to record the sequence of events before it lost power and fell into the water.

When the laser increased to 72 percent output, 300,000 watts, the artifact gently rose off its cradle, at a uniform velocity of 18.3 centimeters per second. When it cleared the laser's beam, the weapon punched a hole in the opposite wall, causing the slight explosion they had heard, as the building suddenly filled with air. The beam didn't do any other damage except to explode a coconut at the top of a tree on the Mulinu'a Peninsula, more than two kilometers away.

The artifact continued rising diagonally until it was poised over the laser's optical fiber gun-barrel. Then, whatever force had been holding it aloft quit. It fell, destroying the laser and collapsing that side of the building into the bay.

The camera didn't record what happened after that, but evidently the artifact floated back up and repositioned itself on the cradle in the now open-air artifact room. When the investigators got to it, a few minutes later, it was still beaded with salt water, and cool to the touch.

This would change the direction of their research.

24. Grover City, California—1948

The changeling enjoyed swimming for a few years as a great white shark—it had had that form for a thousand times as long as the human one.

For reasons it didn't understand, it circled for hours over the deep Tonga trench, and dove as far as it could in comfort. But it was used to having its animal bodies do things out of obscure impulse, and after a while moved on. When it got within a few hundred yards of the California coast, it dropped most of its mass and became a bottle-nosed dolphin.

At two in the morning, it swam into a protected cove, shallow enough to be safe from serious predators, and spent a painful hour turning back into a human

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being.

It used the familiar Jimmy template, but made itself a little shorter and gave itself dark hair with a touch of gray. It changed into Negroid features and very dark skin, and created black pants and a black sweater—burglar gear.

It had to steal some money and information.

The lay of the land was similar to what it had faced the first time it was human; it crossed a short beach and climbed some rocks to find a winding coastal road. It headed north at an easy lope.

Four times it hid from approaching headlights. After a few miles it came upon an isolated service station with a cottage out back.

Perfect for its petty theft. It could make dollar bills as easily as it made clothing, out of its own substance, but it didn't know whether currency might have changed, whether you still needed ration books—whether there might be some completely new wartime system. They might be using Japanese yen, if the war was over.

The placards in the service station window were in English, and none of the them exhorted you to join the services—one did have an American eagle with the instruction to buy U.S. Savings bonds, but not war bonds. Maybe the war was over and the Japanese hadn't won.

The door was locked, but it was a simple one. It turned a forefinger into a living skeleton key, and felt its way through the tumblers in less than a minute.

It wished for moonlight. Even with irises totally dilated, there was little detail.

One wall was shelves full of automobile supplies. It opened a quart of oil and drank it for energy and the interesting flavor, altering its metabolism for a few minutes to something it had used a few hundred thousand years before, lying alongside the vent of an undersea volcano.

It found a box of wooden matches and sucked the end off one, for the phosphorus, and then lit one, with a flare of light and a delicious sting of sulfur dioxide. It saw two things it needed: a 1947 World Almanac and a cash register.

After stuffing the almanac in its belt, it lit another match and studied the machine. Pushing down on the NO SALE key produced a loud chime, and the cash drawer slid out with a metallic hiss.

It studied a twenty-dollar bill in the match light. No obvious differences. American currency had changed in size three years before it had become Jimmy, and people had still been complaining about it.

It gave a cursory check to the ten, five, and one, and put them back into the till. Then the lights went on with a loud snap.

An old white man stood in the doorway with a double-barreled shotgun. "God, a nigger," he said in a squeaking, trembling voice. "I finally got your ass."

Evidently someone had been robbing him. "I haven't," the changeling started, but then there was a loud explosion and it couldn't finish the sentence, for lack of a mouth.

It ducked, and the second shot went high. Sensible of the impossibility it was creating by not falling down dead, it rushed past the man while he was fumbling to reload, forming a large temporary eye out of the gore of its face, and started sprinting down the road.

The old man fired two more shots into the darkness, but the changeling was out of range. The blood and tissues it had left behind turned to dust and fell to the floor.

Once around the first bend, the changeling went off the road and sat in the darkness, working on an appearance less incriminating. Elderly farming woman, caucasian with a deep tan. Faded seersucker dress.

In the moonless overcast night, the

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changeling moved swiftly inland. A few farm dogs howled at its passing. As the gray dawn approached, it hid in an abandoned truck in a wooded area outside of Grover City.

It made itself a purse and filled it with tens and twenties, and at dawn walked into town and sat on a bench outside the train station, reading the almanac.

There was a center section full of grainy black-and-white photographs, giving a history of World War II. There was even a picture of the Bataan Death March. Jimmy's was not among the drawn faces, the wasted bodies.

The Nazi death camps. Hiroshima and Nagasaki. D-Day and Midway and Stalingrad.

The nature of the world was fundamentally different. More interesting.

A boy pedaled up to the station on a squeaky bike, pulling a red wagon full of newspapers. The changeling tried to buy one, but of course the boy couldn't change a ten.

"You look like a nice boy," it said in what it hoped was a convincing little-old-lady voice. "You can bring me the change later."

He *was* a nice boy, in fact, though his face mirrored an obvious internal conflict. He refused the money and gave her a paper. "You just fold her back up after you finish; put her on this here stack by the station door."

It was the 7th of April, 1948. A British and a Russian plane had collided over Berlin, which was evidently split up among the countries that had defeated Germany. Arabs attacked three Jewish areas of Palestine. The House approved the establishment of a U.S. Air Force, and pledged a billion dollars to Latin America to fight communism. Airplane manufacturer Glenn L. Martin predicted that within months America would have bacteriological weapons, guided missiles, and a "radioactive cloud" much more deadly than the atomic bomb.

So the war wasn't really over. It had just entered a new phase. The changeling would stay out of this one.

An obvious game plan would be to go back to college. April was not too late to apply, but there was the problem of high school transcripts, letters of recommendation—the problem of establishing an actual identity with a verifiable past.

As soon as it defined the problem, the solution was obvious.

Four people had gathered. They didn't bother the old farm lady. A train approached, northbound. The changeling folded the paper carefully and replaced it on top of the pile, under the nickels people had left.

As the northbound train approached, the little old lady asked the four whether it was the train to San Francisco. They confirmed that it was, and she got on board.

The conductor changed her twenty with pursed lips but no comment. It continued to read the almanac, storing up information about how the world had changed while it swam around for seven years.

Of course the war had changed the world's map, while leaving whole cities, and even countries, in ruins. The United States had been spared, and now seemed to be leading a coalition of "free" countries versus communist ones. Atomic bombs, supersonic jets, guided missiles, electronic brains, the transistor, and the zoot suit. Al Capone was dead and the changeling's namesake Joe Louis was still champ, which the changeling found gratifying.

At the San Francisco station, it picked up a copy of a woman's magazine and stayed in a stall in the ladies' room for about ten minutes, then emerged as a woman of about twenty, dressed like a college student—two-tone loafers, bobby sox, plaid skirt (that had taken some effort) and a white blouse. It assimilated a chromed toiled-paper holder and recycled it as costume jewelry.

It took the bus to Berkeley and wandered around the campus all day, eavesdropping on people and getting the lay

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of the land. It tarried for quite a while in the Admissions office. College student was an obvious choice of occupation, but which major? It remembered all it had learned about oceanography, but of course would have to hide most of that, starting over. Physics or astronomy might be useful, and interesting, but if it were to track down others of its kind, anthropology or psychology—abnormal psychology—would be more useful.

Of course it had time for all of them.

It studied the posture, demeanor, and uniform of a janitor, and as darkness fell, let itself into an empty classroom and changed. There were still a few students hanging around in the halls, but a bald fifty-year-old man with a broom was invisible to them.

Around midnight, the changeling slipped into the Admissions office and locked the door. It moved swiftly and quietly, the room adequately lit, to its eyes, from the dim dappled light that filtered through a tree from a street light at the end of the block.

There were about fifty return letters from prospective students in the in-box of the young woman the changeling had earlier identified as the most junior secretary. It read through forty of the letters before finding exactly what it needed.

Stuart Tanner, a boy from North Liberty, Iowa, had sent in a letter thanking them for his acceptance, but saying that Princeton had offered him a scholarship, which of course he couldn't pass up. The changeling found his file in the "Acceptance" drawer and memorized it. He had an almost perfect academic record. No athletics other than swimming team, which was good. The photo was black-and-white, but he was a pale Nordic boy, blond and blue-eyed. The changeling took his face and noted that he'd have to assimilate about twenty pounds.

After making sure there was no one else on the floor, the changeling typed a letter of acceptance, noting that he was driving out to California immediately, for a summer job, so please change his address to General Delivery in Berkeley. It switched the letters and slipped out the door, a new man.

The most direct thing to do would be to go to North Liberty and quietly kill Stuart Tanner, and bring his wallet full of identification back to Berkeley. But that wouldn't be necessary. It would be sufficient to absorb enough of North Liberty to be able to pass for a native. Stuart grew up in Iowa City, so he'd have to check that out, too. An Iowa driver's license would be easier to counterfeit than a twenty-dollar bill.

The changeling had seen enough killing in the Pacific to reserve it as a course of last resort.

Stuart Tanner had wanted to major in American Literature. That would be an interesting challenge. The changeling could read a book a day before September, and be ready for that. It could minor in psychology and take an anthropology elective, that would grow into a second bachelor's degree. Then graduate work, searching for creatures like itself.

It wandered through Berkeley until it found an all-night cafe where it sat down with a course catalog it had taken from the office, and mapped this out. Then it scanned the rest of the almanac, appearing to be flipping through it, looking for something. At first light, it walked back to the train station and booked passage through to Davenport, Iowa, which appeared to be the closest stop to North Liberty.

With three hours to go before the train left, it bought a suitcase at a pawn shop and packed it with used clothing from Next-2-New. At a used book store, it bought two thick anthologies of American literature and a half-dozen tattered novels.

It wouldn't do to be walking down the main street of North Liberty and run into Stuart Tanner or someone who knew him. In a stall in the busy men's room at the train station, he changed his hair to black and skin, swarthy. He flat-

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tened his nose and made his blue eyes brown.

The changeling had reserved a private compartment on the train, since it was only money. At five till eleven it went aboard and settled in.

It took most of the Rocky Mountains to read through the *Norton Anthology of English Literature*, and before it got to the Mississippi it had read one book each by Poe, Hawthorne, Melville, Fitzgerald, Hemingway, and Faulkner. It had every word memorized, but knew from previous college experience that that wouldn't do the trick. Jimmy had been able to write well enough, just barely, to get a degree in oceanography, but his grades in English had been unimpressive. That would have to change.

Among Stuart's application materials was an eleven-page essay on why he wanted to major in American Literature. The changeling had memorized not just the words, but also the handwriting. It copied the essay out twice, trying to understand why the writer had used this word rather than that; why it chose one sentence structure over another. Every time it finished a novel it wrote a few pages about it, trying to mimic Stuart's style and vocabulary; a plot outline and analysis of the author's intent, as it had done without great success in the required English and literature courses at U. Mass. By the time the train got to Davenport, it had worn its pencil to a nub, filling most of a thick tablet.

The Mississippi looked interesting. Maybe some day it would turn into a huge catfish and explore it.

It waited out a thunderstorm, since that's what a human would do, and then walked to the bus station. With a two-hour wait, it read two Iowa papers and reread, in its mind, *The Sun Also Rises*, which was clear but mysterious: why were these people so self-destructive? The war, it supposed; the previous one. Though it looked as if there might be just one World War, with breathing spaces for re-arming, that would last until somebody won.

The ride to Iowa City was interesting; the bus rumbling past mile after mile of constant green, farmland occasionally punctuated by wild prairie or forest. There were individual farm houses with barns, always red, but no towns until they pulled into Iowa City.

The bus was going on to Cedar Rapids, but the driver directed him to the train station, the Cedar Rapids and Iowa City Interurban Railway, which went up to North Liberty. The changeling walked through the university campus to get there, noting that students dressed about the same way they did in Berkeley. A little more casual, not as much obvious wealth. More pipe-smoking among the males, fewer women in slacks. Dresses to mid-calf.

It had been listening carefully to conversations. There was a characteristic Iowa accent, but it had been more pronounced in the Davenport station. It would try to maneuver into a situation where it could overhear Stuart.

Stuart had gone to high school in Iowa City, the changeling knew from his records, so on a hunch it let two trolleys go by. Sure enough, when school was out, teenagers started arriving in groups of twos and fours.

Except Stuart, who walked alone, reading a book. He didn't talk to any of the others, and they ignored him.

The changeling maneuvered close to the boy and studied him surreptitiously while appearing to read its own book. He was slim and muscular, with a delicate manner. The book he was so absorbed in was the twenty-year-old *Coming of Age in Samoa*, which the changeling had read as an undergraduate in 1939.

When the trolley came, the changeling got on behind Stuart and sat next to him. "Interesting book."

Stuart looked up sharply. "You've read this?"

"My father had a copy of it," the changeling improvised. "One of his text-

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books in college."

"He let you read it?"

"No . . . I put the dust jacket around another book. He never missed it."

Stuart laughed. "My dad took it away from me. This one, I keep hidden when I'm home. But hell, I'm old enough."

The changeling nodded vigorously. "They're afraid you'll get ideas."

"As if that was bad." He looked at the changeling. "You're new?"

"Just passing through. Visiting relatives."

"What, in Liberty?"

The changeling thought fast. North Liberty only had a few hundred people; Stuart would know most of them. "No, Cedar Rapids."

"Where you from?"

"California. San Jacinto."

Stuart looked introspective. "Always wanted to go there. I was accepted at Berkeley. Didn't get a scholarship. Are you a student?"

"Taking some time off." It checked its watch. "Anything to do in North Liberty? I have a couple hours to kill."

"They would die," Stuart said. "Ice cream parlor, really just a soda fountain. Go out and look at the quarry."

"What do they mine?"

"Sandstone." He laughed and jerked a thumb back at Iowa City. "Did all the sandstone for the Capitol Building there. Then they moved the capitol to Des Moines."

"And carelessly left the building behind," the changeling said in an attempt at humor. The boy gave him an odd look and laughed.

"You could kill an hour with a soda. Or go on to Cedar Rapids and get an actual beer."

"A soda sounds good. I like small towns."

"You could see all of Liberty in about ten minutes." They talked for a while more, the changeling mostly listening or mining the memory of the day's papers.

They both got off at North Liberty, along with a couple of dozen students. Almost everyone went down the main street. When they went into the ice cream shop, a girl behind them said in a soft sing-song, "Stew-ie's got a boy friend."

He turned pink at that. "Stupid girl," he muttered, as the screen door smacked shut behind them.

Interesting, the changeling thought. Could free-thinking Stuart be homosexual, attracted to the exotic out-of-towner? Dark and handsome, with a body almost a twin of Stuart's, defender of Margaret Mead.

They sat at a small round marble table by an oscillating fan. The changeling looked at the bill of fare, a small two-sided card. "How 'bout I buy us a banana split? I couldn't eat a whole one."

"I'll split it with you." He reached into his pocket.

"No, my treat. I'm researching the odd inhabitants of this island."

He snorted. "Margaret Mead wouldn't find much here."

"Oh, I bet she would. Probably about as many people here as on her island."

"Yeah, and we go around half-naked and screw anyone we want." They both laughed at that.

The soda jerk, a young red-head with a face full of acne, was approaching with his pad. He gave them an uncertain smile. "Where's that, Stu?"

He held up the book. "Samoa, Vince. We're gonna go there soon as school's out."

Vince gave the changeling a funny look. "Sure you are. Where the hell is Samoa?"

"Middle o' nowhere, in the Pacific."

"They fight there?"

"Don't know." He raised eyebrows at the changeling.

"Don't ask me." The changeling had passed the island group as a great white shark, on its way to California, and hadn't seen any naval presence. But the war still had a few years to go, then.

"So hi," he said. "I'm Vince Smithers. You're not from, uh . . ."

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"Matt Baker," the changeling said, and shook his hand. "San Jacinto, California." This was interesting. The changeling had some difficulty reading subtle emotions, but jealousy isn't subtle. "We're gonna split a banana split, and I'll take a Coke."

He scribbled that down and looked at Stuart. "Vanilla Coke?" Stuart nodded and he went back to the fountain.

"You guys know each other?" the changeling said.

"Everybody knows everybody here. Vince and me used to go to school together, but his parents put him in a military academy. What was that shitty place, Vince?"

"God, I don't want to say the name. I left to pursue a career in banana-split-ology. Much to my father's delight."

They continued in a kind of uneasy banter, the changeling watching with an anthropologist's eye. They were less exotic to it than Polynesians, but no less interesting.

There was a conspiratorial edge to their exchange. They had done something forbidden together, something secret. Not necessarily sex, but that would be a good first guess. Did Stuart mean for his new companion to make that inference? The changeling's only experience with homosexuality had been in the asylum, and there had been no social aspect to it; he had just been a receptacle for two of the guards. There had been a third, who only came to him once, and had been more interesting than the two brutes: he had quit after a couple of minutes and started weeping, and said how sorry he was, and evidently quit the job right after.

It was so much more complicated than it had to be, but the changeling had noted that this was true of every human biological function that wasn't involuntary.

Vince brought the split and Stuart's Coke. "You don't want some vanilla in yours?" he said to the changeling.

A complexity. "Sure. I'll try anything once." Vince nodded grimly. It was an obvious turning point.

They divided the confection meticulously, and pursued it from opposite ends. Stuart told the changeling about his scholarship to Princeton.

"Nice campus. Major in anthropology?"

"No, English and American lit. You've been there?"

"Once, visiting relatives." A semester, actually, studying invertebrate paleontology.

"You have relatives everywhere."

"Big family."

He made a face. "Mine are all in Iowa." He said it as "Io-way," with a downward inflection.

"You don't plan to come back and raise a bunch of Iowans yourself?"

"No and double no. Not that I don't *like* kids." He speared a piece of banana. "I *hate* them."

"Brothers and sisters?"

"Thank God, no. The kids at school are bad enough."

The changeling was absorbing all this avidly. They finished the split. "Well. Want to show me around fabulous North Liberty?"

"You got five minutes?" On the way out, the changeling gave Vince a dollar and airily waved off the change.

"Rolling in dough," Stuart said.

"Best crap shooter in San Jacinto."

"*Bull* shooter." They both laughed.

It actually took about ten minutes. From the center of town, Stuart led him down West Cherry Street.

"This is my house," he said. "Want to come in?"

"Sure. Meet your parents."

Stuart looked at his eyes, exactly level. "They're gone. They won't be home till tomorrow."

The changeling returned his gaze. "I don't have to be in Cedar Rapids till tomorrow. Missed my train."

The courting ritual was brief. Stuart raided his parents' liquor cabinet and fixed them bourbons that were much

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too large and strong. Just fuel to the changeling, of course, but if Stuart had been older, it might have killed his sexual desire.

It didn't, of course. He lurched up the stairs, dragging the changeling by the hand, into a bedroom that was not at all boyish. No models or posters, just hundreds of books in nailed-together bookcases.

Afterwards, the boy slept in its arms, snoring drunkenly. It analyzed the genetic material he had left behind. He had cholesterolemia, and should take it easy on the banana splits. Also diabetes in his future. Maybe just as well he didn't want to reproduce.

25. Apia, Samoa—2021

There was no way they could keep it secret. For one thing, a longboat crew was practicing less than a kilometer away. They heard the explosion when the laser punched through the wall of the building full of vacuum. All thirty-four were still staring when the side of the building collapsed and there was a huge spray of water.

From their angle they couldn't see the artifact. But the building was continually monitored by an automatic extreme-telephoto camera that CNN had mounted on a hillside on Mt. Vaia, overlooking the bay. It caught the building's collapse, and zoomed in on the artifact rising leisurely back up to its original position.

No one on Samoa knew that there was a hasty conference in Washington five minutes later, the president pulled out of a late-night poker game to help decide whether to vaporize their island. Somebody was disingenuous enough to point out that it really wouldn't be an act of war, since there were no hostilities between the two nations, and one of them would no longer exist after the explosion. The president's response to that was characteristically curt, and he went back to his game after demanding that a summary of events be on his table in the morning.

It would be one short page. Poseidon wasn't talking, and the NASA team abided by their agreement.

They ran the tape over and over, along with the sensor data, and on the hundredth viewing they knew little more than on the first. As the laser cranked up to 72 percent of full force, the temperature of the artifact began to increase, all over. When it was 1.2 degrees Centigrade above the ambient temperature, it rose diagonally off its cradle at 18.3 centimeters per second, traveling at a 45 degree angle until it was over the laser's output tube. Then it fell to the floor. It was like dropping an apartment building on a wine glass. The floor didn't resist.

The part under the cradle didn't collapse; it was independently supported. It probably *would* crumble if the artifact had fallen on it, too. But it seemed only interested in the laser. When it came back up, it settled into the cradle as gently as a feather.

The researchers had to study the CNN record of that part, their ruggedized camera lying ruggedly on the bottom of the bay, its back-up power source sending a record of swirling silt. Exactly 1.55 seconds after the splash, the artifact rose back out of the water, still at a constant rate of 18.3 centimeters per second, and settled back into its cradle. The scene was unchanged when Russ and Jan pedaled up a couple of minutes later.

While a work crew nervously reconstructed the artifact room and its protective surround, a separate NASA crew—at least they wore identically new NASA coveralls—retrieved the drowned laser and power source and analyzed the damage. It was profound.

Jack Halliburton didn't normally walk into Cottage #7 unannounced. The crowd of nine who were sitting around the table piled high with reports and lunch remains fell silent when he came through the door.

Russ was one of the most surprised. "Jack. You want a sandwich?"

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He shook his head and sat down on the chair offered. "Get me the output curve for the laser just before the artifact fell on it."

Moishe Rosse, who had become their laser guy, picked up two cylindrical keyboards and started surfing, the big TV acting as a monitor.

"It's a simple step function," Russ said. "Turns off."

"I know. I want to know exactly when and why."

"Good luck with the why." The innards of the power source were deeply classified; they used it as a black box that always delivered what you asked.

"They told me a little something." A familiar graph appeared on the screen, the output of the laser slightly rising and then falling off abruptly. The abscissa of the graph was ticked off in microseconds.

"Give me a split screen and let's see what happens on the real-time tape a couple of microseconds before it turns off."

The artifact was slowly rising, two millimeters per microsecond. The image rolled around slowly—the slow-motion record of violent dislocation—when the laser beam slid under the artifact and punched through the opposite wall.

"Hold it. Stop it right there." The frame's time was 06:39:23.705. The graph showed the power shutting off at 06:39:23.810.

"More than a tenth of a second. So?" Russ gestured at the screen. "What did they tell you?" They had assumed that either the laser had shut off automatically, via some internal safety circuit, or the violence of the implosion had done the job. The Feds weren't talking.

Jack was silent, staring, for a long moment. "What evidently happened," he said, "at 23.810, was that all the plutonium in that reactor turned to lead."

"Turned to lead?"

"Yeah. That's why it stopped working. You can't get blood out of a turnip."

"Good God," Moishe said. "Where did all that energy go?"

"At a first guess, inside our little friend."

"How many grams of plutonium?" Russ said.

"They're still not talking. But they acted nervous as hell. I don't think they have grams on their collective mind. I think it's tons, kilotons, megatons."

"TNT equivalent," Russ said.

Jack nodded. "They want to evacuate the island."

"Megatons?" Russ said, his eyes widening. "What have we been sitting on?"

"Like I say, they're not talking numbers. Besides, I have a suspicion that they're also not talking about the *thing* blowing up. I think they want to be free to nuke it to atoms if it looks dangerous."

"'If'!"

Jack looked around the room. "I suspect we'll lose some of our crew here, too. Can't say I'd blame anyone for leaving."

Moishe broke the silence. "What, when it's just getting interesting?"

They weren't going to move 200,000 Samoans just by saying "You're in danger; you have to leave." For one thing, the "independent" in Independent Samoa applied mostly to America. Anybody who wanted to live under Uncle Sam's thumb could take the ferry to American Samoa.

There was also the matter of where to put them. American Samoa was dismally crowded. New Zealand and Australia were virtually closed, having absorbed more than 100,000 Samoans over the past century—and that emigration of course siphoned off the ones who wanted to leave the traditional lifestyle.

The other islands in the group were mostly impenetrable jungle or volcanic waste. Sava'i had 60,000 people crowded into a necklace of towns along the inhabitable coast, and didn't want more.

Besides, most Samoans were deeply

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religious and somewhat fatalistic. If God chose to take them, He would. And it would be disrespectful to the point of sacrilege to leave their homes, with generations of ancestors buried in the front yards. Pollsters said that even if the U.S. completely paid for relocation, they'd only move about 20 percent of the population.

Samoans pointed out that it would be a lot simpler to move the artifact. The land didn't belong to Poseidon, let alone to the U.S. government; it was leased. The family that owned the land could evict them.

Jack applied his skills as a negotiator to that aspect of the problem. He had a meeting with the local village elders, the *fono*, and pointed out that evicting them, while a defensible act, had its negative side. It would be, in effect, capitulating to U.S. nuclear might. It would be a breach of agreement—an agreement that involved far more money and prestige than the village had ever known—and some would see that as a humiliation. Besides, if they cooperated, Jack would, in gratitude, renovate both schools and build a new church.

He never mentioned Poseidon. The deal had been with him.

It wound up costing the renovation of two more churches and the sponsorship of a celebratory feast. But honor won the day.

(The fact that the Samoan national government wanted the village to evict Poseidon had worked to Jack's advantage. The primacy of village law was written into the constitution, and there was no question that in matters of real estate—a touchy subject on the finite island—village law trumped the feds. The elders took pleasure in reaffirming this principle.)

The rebuilding was profound. The dome over the experimental area, besides providing environmental isolation, was to serve as a double blast confinement volume, a dome of titanium inside a dome of steel. Jack and Russ and Jan united in opposing the extra expense and complication. If the artifact decided to explode, the domes might as well be made of cardboard.

The government, still under the aegis of NASA but with much more money and clout than the agency possessed, agreed that they were probably right. The double dome was a just-in-case precaution.

Also "just in case" were the manacles that supposedly held the artifact down, attached to arm-thick cables that were deeply anchored in bedrock. They had calculated the amount of force it had taken to lift the artifact off its cradle; the manacles could hold down four to six times as much. No one who had seen the airy effortless grace with which the artifact had floated up would bet on the cables.

It was Jan's turn to run the show. Having scalded and frozen and zapped the thing, with no result other than disaster—maybe now it was time to talk to it.

26. Berkeley, California—1948

College was harder the second time around. Oceanography had been a natural pursuit for the changeling; English and literature were not, especially in the advanced classes mandated by Stuart's performance in high school. The changeling ground through one semester and changed its major to anthropology.

Anthro was a natural, too, since it had been objectively studying the human race for sixteen accelerated years. The only problem was limiting its class responses and papers to perceptions appropriate to a bright but unworldly lad from Iowa—who had never been in an insane asylum or boot camp, and had only read about Bataan in the newspapers.

The changeling changed. It would never be human, but it was human enough for something like empathy with its professors. They were trying to understand, and teach about, the hu-

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man condition—but were themselves trapped in human bodies; stuck in human culture like ancient insects in amber.

The changeling had an advantage there. Whatever it was, it wasn't human. It began to suspect it wasn't even from Earth.

A few months before it had come up out of the sea onto California soil for the second time, a pilot named Kenneth Arnold had seen a formation of flying discs weaving through the Cascade Mountains of Washington State. People on the ground reported seeing them, too.

Then there was a lot of excitement over one of them crashing outside Roswell, New Mexico, though the Army Air Force investigators said it was just a weather balloon. Belief in the "flying saucer" explanation persisted, though.

During the changeling's first year at Berkeley, an Air National Guard pilot crashed while trying to intercept an Unidentified Flying Object, as they had come to be called. The Air Force (as *it* had come to be called) established Project Sign to investigate UFO's.

The changeling followed press reports avidly. As it turned out, though Project Sign's report rejected the idea of extraterrestrial origin, saying UFO's were misinterpretations of natural phenomena, an earlier Top Secret "Estimate of the Situation" apparently thought otherwise. But that would stay Top Secret for a long time. Project Sign was changed to "Project Grudge," and when it was terminated at the end of 1949, the Air Force explicitly denied the possibility of extraterrestrial origin, adding mass hysteria and "war nerves" to the natural-phenomenon explanation, and also said that many of the reports were cynical frauds by publicity-seekers or hallucinations of psychologically disturbed people.

Most of the changeling's anthropology professors went along with the mass-hysteria/war nerves explanation, but many of the students felt otherwise. They thought it was a government cover-up.

There were plenty of books and magazines to support that point of view, but the changeling found them unconvincing, even though it was pretty sure there was at least *one* being from another planet on Earth. By the time Project Blue Book supplanted Project Grudge, the changeling was looking elsewhere.

It searched both legend and science for shapechangers; for people suspected of being immortal, invulnerable. There was a lot more legend than science, all of it conveniently buried in history and hearsay.

It slipped away from Berkeley during vacation periods to search down and interview some suspects: two men who shed their skin every year, like snakes, and a woman who claimed to shed bones, just sliding them out through her skin. The woman was a fraud and the two men were apparently humans, but dermatological freaks. One of them had carefully peeled off a hand, outside-in, over the course of weeks; he let the changeling put it on like a glove.

All human. But the changeling itself had instinctively hidden its true nature from the beginning, and had so far been successful. Others would probably do the same.

It briefly considered running ads in big-city newspapers—"Are you fundamentally different from the rest of humanity?"—but knew enough about human nature to predict the kind of response it would get.

It didn't think about the possibility of someone like the chameleon, who might track down the ad's creator with murderous intent. But then it didn't think it could die.

27. Fort Belvoir, Virginia—1951

The chameleon also took an interest in UFO's; unlike the changeling, it moved in on the source of information.

It had spent thousands of years in

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armies, and in fact had been a captain in the Army Air Force, flying over Germany in World War II. It had faked its death there, and so couldn't just re-enlist, and Korea was kind of unappealing anyhow. But it knew enough about military red tape that it was only a matter of patience to make itself an E4 clerk on the Pentagon staff, Airman (a title only a month old) Fourth Class Patrick Lucas. Once there, it listened to scuttlebutt and managed to move itself into Project Blue Book.

Once there, it gave itself a promotion in an irregular way, which it had done before: when a new bachelor officer was assigned to the project, the chameleon studied his personnel file, befriended him the first day, got him alone in his apartment, and killed him.

In the bathtub it performed a rough-and-ready autopsy, thorough enough to ensure that the officer was indeed human—because something like the chameleon, if such existed, might also be drawn to Blue Book.

It wrote a suicide note for Airman Lucas, and at two in the morning traded uniforms and dog tags with the officer. Drained of blood, the officer looked like a pale, passed-out drunk. The chameleon carried his body quickly to its car, and drove to the end of a dirt road outside of Vienna, Virginia. It saturated the body and the front seat with gasoline, tossed in a match, and changed its appearance, almost instantly, to match the officer's. Then it ran through the woods back to civilization.

The short newspaper article only said that the body had been burned beyond recognition, but the car was registered to a Pentagon clerk. Investigators that morning found the suicide note, and the case was closed. Co-workers shook their heads; he always had been a loner.

The new lieutenant seemed to be a loner, too, and once the theory that he was a plant from the CIA was whispered around, people pretty much did leave him alone.

The chameleon-lieutenant's function for several months was to winnow through UFO reports, to find the 10 percent or so that warranted some follow-up. It ordered calendars back to 1948, and with the aid of an ephemeris, marked off the evenings and mornings when the planet Venus was particularly bright. That saved a lot of time.

It knew about Projects Sign and Grudge, and was not surprised to get the feeling that Blue Book was less interested in scientific evaluation of UFO reports than in public relations, mostly debunking. Some people saw evidence of a conspiracy there, but the chameleon just saw the conservative military mind at work. Project Blue Book was basically one officer and a few low-ranking clerks, with a couple of dozen other people, military and civilian, poking their noses in every now and then.

It seemed to spend as much time dealing with the press and politicians as with UFOs. Whenever there was a slow news day, reporters would show up or phone, in search of copy. Politicians would demand to know why nothing had been done about some sightings in their districts.

With a typically military instinct for putting the right man in the right job, they put the chameleon in charge of the phone. Of course, it had had thousands of years' experience in dealing with people. But tact had never been its usual weapon of choice.

The chameleon observed its fellow investigators as keenly as it did the pilots and police and farmers who had reported the phenomena, reasoning that if there were something else like it in the world, it might gravitate to Fort Belvoir. But its counterpart was on the other coast, involved in the same pursuit in its own way, having given up on flying saucers.

After another year, the chameleon did, too. One day, instead of reporting for duty, it drove on into Washington and bought a wardrobe of work clothes

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from used-clothing stores, and by the time its superiors realized one of their investigators had gone AWOL, it was working on a dairy farm in Western Maryland.

28. Apia, Samoa—2021

The idea of signaling alien intelligence with a message that didn't depend on language went back to 1820: the mathematical genius Carl Friedrich Gauss suggested clearing an immense section of Siberian forest, and then planting wheat in three squares that would diagram the Pythagorean Theorem. An observer on Mars would be able to see it with a small telescope.

There were other schemes in the nineteenth and twentieth centuries, involving mirrors reflecting sunlight, huge fires demonstrating geometrical shapes, or cities blinking their lights on and off.

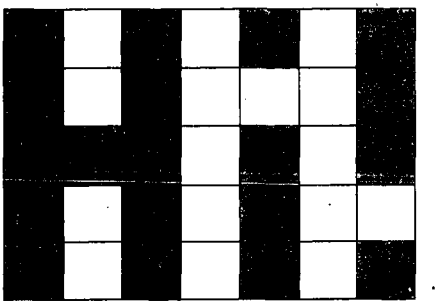
Around 1960, Mars no longer a compelling target, Frank Drake and others suggested an elaboration of this "Morse Code" approach that would be visible from interstellar distances, using radio telescopes as transmitters rather than antennas, sending out a tight beam of digital information. The reasonable assumption was that any civilization advanced enough to receive the message would be able to understand binary arithmetic. So they sent, in essence, a series of dots and dashes that said "1+1 = 2," and went on from there.

The idea was to establish a matrix, a rectangle of boxes that would make an understandable picture if you made some of the boxes (corresponding to "1") black and left the others (corresponding to "0") white—like a crossword puzzle before it's filled out.

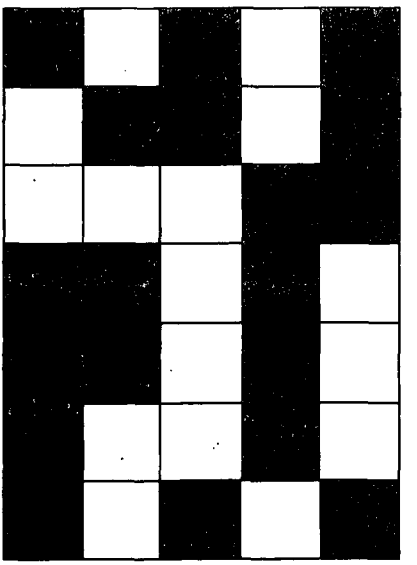
For it to make sense, you had to know the dimensions of the rectangle. The easiest way to do it would be to broadcast the information one line at a time, with pauses between the lines. Then a longer pause, and repeat the same thing over, for verification.

That does take a long time. Drake suggested that a single long string of ones and zeros would suffice, if there were some way to tell how many of them made up each line.

Prime numbers were the answer. Any pair of prime numbers, multiplied together, produces a number you can't arrive at with any other pair. The number 35 can only come from 7 times 5, so a sufficiently clever alien could look at this string of ones and zeros—10101011010001111010110101001010101—and come up with this rectangle:



Of course, a 5 X 7 rectangle is just as likely, but gives this:



—which we would hope is not insulting in the alien's language.

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With a large enough number of spaces, the difference between order and chaos is obvious. Drake's example was 551 characters, which made a map 21 X 19 spaces up and down. Of course it didn't spell out an English word; in fact, it was meant to be an *incoming* signal: it showed a crude drawing of an alien creature and a diagram of its solar system, along with other shapes that indicated it was carbon-based life, that it was thirty-one wave lengths tall, and that there were seven billion individuals on its planet—and three thousand colonists on the next planet in, and eleven explorers on the next one.

The message Jan would send the artifact used the same technique, though it could be much more elaborate, since the receiver was inches away rather than light years. Starting with the same arithmetic and mathematics, it went beyond a stick-figure-plus-DNA diagram to present digital representations of Einsteinian relativity, photographs of several different people, a Bach fugue, one of Hokusai's views of Fujiyama, and Vermeer's "Girl With a Pearl Earring" in black and white.

The signal took about fifteen minutes to transmit. Focusing on various parts of the artifact, they beamed it in every frequency from microwave to X-ray; they tapped it out mechanically on the thing's surface. Of course there was no way of predicting what its response would be. Maybe it *was* responding in some way they couldn't detect—saying "shut up and give me some peace!" It was reasonable, though, to expect that it would respond in a way similar to the message: light or sound in a similar binary sequence.

Of course it might just be a dumb machine, capable of moving itself out of harm's way, and nothing else.

After two weeks of no results, Jan was discouraged. She asked Russ and Jack to meet her at the Sail for dinner and strategy.

The two men showed up together just as the sundown storm started. The setting sun was a dull red ball on the horizon while sheets of rain marched sideways across the harbor. No thunder or lightning; just an incessant downpour.

"Another wonderful day in paradise," she said.

"ET hasn't phoned home?" Jack said as he sat down.

"What?"

"Before your time." The waiter appeared with the wine list. Jack waved it away and ordered a bottle of Bin 43.

"So what do you think?" Russ said.

"Oh, I don't know." She refilled her coffee cup from a silver Thermos flask. "I guess it's time to move on to the planetary environments phase. If it reacts to anything, I can repeat the Drake algorithm then." She sipped the coffee. "As you say, Russ, maybe it's asleep or in some dormant mode. Maybe if we reproduce its home planet's conditions, it will be more inclined to talk."

Jan winced as a shift of wind sent a fine spray over them. "Waiter," Jack said, standing and pointing to a table just inside. He carried Jan's coffee flask back in, and while a woman lit candles, the waiter appeared with a bottle and three glasses.

"I'm willing to be patient," Jack said, going through the tasting ritual.

"It's not a matter of patience." She put her hand over her wine glass. "I feel as if we've gone as far as we can in this direction."

"Well, we knew it was going to be all or nothing," Russ said. "Just one peep out of the thing and we'd be . . ." He rose an eyebrow and took a sip of wine.

"Yes, we would," she said. "But we're not. Let's move on."

"Starting at square one?" Jack said. "Mercury?"

"We could start anywhere," Russ said. "Mercury is going to cost out better. Just hot vacuum."

"So there's a decision?"

He looked at Jan. "Acoustic. We want

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to continue tapping out your message on the thing's surface. If it responds acoustically, we won't hear it in a vacuum."

"We can run a taut wire from it," Jack said, "like a tin-can telephone."

"Hard to get it through the wall without damping vibrations."

Jack shrugged. "So don't run it through." He spread out his napkin and clicked a pen open. He drew a square inside a square and attached the inner to the outer with springs. "See? You have your taut wire pulling on the back of *this*"—he tapped the inner square—"and it acts like an old-fashioned speaker. It's gonna vibrate in a way that mimics the artifact's vibrations."

"But we still can't hear it," Jan said.

"Ah, but we can *watch* it. Draw a grid on the square and put a camera on it."

"Fourier transforms," Russ said with approval.

"Duck soup," Jack said.

"We have no duck," the waiter said. He was standing behind Jack's shoulder. "We have clam chowder or chicken with mushrooms."

Russ looked at him and decided he wasn't joking. "I'll have the chowder and grilled masi masi."

"Me, too," Jan said.

"The usual," Jack said.

"Cholesterol with cholesterol sauce," Jan said.

"You will have a red wine with that?"

"Bin 88," Jack and Russ said simultaneously. "And I want it really *blue* this time," Jack said of his steak. "Cold in the center."

The waiter nodded and left. Russ imitated his accent: "Sir, we cannot guarantee that you will survive this meal. Samoan cattle have parasites for which there are no Western names."

Jack smiled and refilled both glasses of white wine. "Mercury, and then go on to Mars? Vacuum with a little carbon dioxide. Then Venus and the gasbags."

"Good name for a rock band," Russ said.

"Titan?" Jan said. "Europa?"

"Makes sense," Russ said. "And just outer space, 2.8 degrees above absolute zero. It probably spent a long time in that environment."

"Hold on," Jan said, and took an old computer out of her purse. She unrolled the keyboard and pulled out the antenna and typed a few words. "Let's be methodical here. Starting with the mercurian environment." They got halfway through the solar system before dinner came, and finished it over sherry and cheese, mapping out a rough schedule. They would spend five days with each environment, and one to four days in transition.

Hot Mercury, cool Mars, hellish Venus, cold poison Titan, arctic Europa, then the jovian model: high-pressure liquid hydrogen and helium, flowing at about 150 meters per second, flavored with methane and ammonia.

Jan took a sip of sherry and scrolled through the schedule. "Something bothers me."

Jack nodded. "The pressure chamber's—"

"No. What if the thing misunderstands? What if it thinks we're attacking it?"

Russ laughed nervously. "I thought I was the anthropomorphic one."

"If it does its little jump-off-the-pedestal trick while it's in the Jupiter simulation . . ."

"Be worse than a cookie-cutter bomb," Jack said. "Flatten everything out to here. They'll hear it in American Samoa."

"In Fiji," Russ said. "Honolulu."

29. Cambridge, Massachusetts—1967

For a few months, the changeling and the chameleon were in the same city, doing more or less the same things.

The chameleon was at MIT, studying marine engineering. It had enjoyed Korea as a naval officer, and wanted to learn more about the design of war-

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ships.

It liked anything about killing.

The changeling had gotten its doctorate in anthropology in 1960. Combining its deep knowledge of Earth's biology with a broad knowledge of the cultures that crawled all over the planet convinced it that it had to be from somewhere else. So it went to Harvard with impeccably faked credentials (again a boy from California) and began the study of astronomy and astrophysics.

If they ever rode together on the Red Line or had a beer at the same time at John Harvard's, they were unaware of being in the company of a fellow extraterrestrial. They were both looking for other aliens; they were both too experienced to be found out.

Neither one was drafted for Vietnam. The changeling faked severe stomach ulcers. The chameleon finished its Master's Degree and joined Officer Candidate School.

So while the chameleon pointed eight-inch guns at unseen targets in the Vietnamese jungle, the changeling pointed huge telescopes at unseen targets outside the Galaxy. It mostly counted photons and put the numbers into a BASIC program, which dispensed something like truth. Sometimes, unlike professional astronomers, the changeling unhooked the telescope from its photon counter and actually looked through it at the night sky.

It was fascinated with globular clusters, and eventually hunted down all of the hundred-some visible from Massachusetts. It saw its home, M22, as a fuzzy blob shot through with sparkles, and returned to it many times without knowing why.

The changeling had a master's in astronomy by 1974, but felt it had to know more about computers before continuing on, so it moved down to MIT for a couple of years, studying electrical engineering and computer science.

Two of its professors had taught an alien before.

It liked the area, and so returned to Harvard for its Ph.D. in astrophysics, where it had another coincidental encounter. As part of its graduate assistantship, it graded papers for an elementary astrophysics course, "The Atmospheres of the Sun and Stars." One of its students was Jan Dagmar, who it would meet more than forty years later, in Samoa.

Harvard followed the tradition of kicking its chicks out of the nest, so after its doctorate, the changeling had to look elsewhere for work. The natural place was the National Radio Observatory in Green Bank, West Virginia, where Frank Drake had started Project OZMA, which after twenty years had evolved into the SETI Project, the Search for Extraterrestrial Intelligence.

The changeling worked there, massaging data, for two years, and then took an indefinite leave of absence, and a series of profound career shifts. It was an exotic dancer and part-time prostitute in Baltimore for awhile, then a short-order cook back in Iowa City. As an old lady, it read palms in a county-fair circuit in the Midwest, and returned to California in its old Jimmy body to be a surf bum for a couple of seasons.

Sacrificing half its mass, it became a juggling dwarf with the Barnum & Bailey Circus, making contacts in the freak world. It met some interesting people, but they all seemed to be from Earth, no matter what they claimed.

It married the Bearded Lady, an even-tempered and sardonic hermaphrodite, and they lived together until 1996. The changeling left behind a hundred ounces of gold and no explanation, and became a student again.

After absorbing two stray dogs, it went back to the Jimmy template, but took the body past California and down to Australia. It studied marine science at Monash University, aware that most of what it had studied a half-century before had been profoundly revised.

It had learned to trust certain feelings—memories buried so deep they

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were no longer memories—and one of those feelings was a special affinity for deep waters, and the Pacific.

30. Apia, Samoa—2021

They decided it would be prudent to build a blast wall between the laboratory and the island, before starting the planetary environment experiment. If the Jupiter simulation blew up, they might still hear it in Fiji, but at least it wouldn't level Apia.

The wall was three meters thick at its base, curving up to one meter thickness at the top, ten meters high. It was a semicircle 150 meters in diameter, open to the sea. Local artists were hired to paint bright murals on the land side, but it was still an eyesore. The local *fono* was appeased by a school-bus and two stained-glass windows for the Methodist church.

In the event of an explosion, all the force that would have gone landward should be diverted straight up or expended on destroying the blast wall, which was made of a foamed concrete that would boil off rather than break.

But they were months away from Jupiter. The original plan had been to start with Mercury, but the technical staff argued for doing Mars first. Two of the techs, Naomi and Moishe, had gone to Florida and been fitted with modified NASA space suits, and spent a few weeks training with them. They could comfortably enter the Martian environment and check out the situation. Mercury was marginal; their suits' air-conditioning could only handle it for short periods. It was logical to start the experiment under conditions that allowed continuous direct human contact.

So for the first couple of days, Naomi and Moishe walked around on their tenth-acre of "Mars," checking the place for leaks from the outside world, running tests on all the sensors and communication devices in the relatively clement environment.

Only relatively: the atmospheric pressure was pumped down to about a hundredth that of sea level, and there was no oxygen in their brew, just carbon dioxide with traces of nitrogen and argon. It was refrigerated down to -100 degrees Centigrade, and cycled up to a balmy 26, simulating the Martian equator during the summer. The ambient light was dim and pink, heavy on the ultraviolet.

The environment caused no serious problems, so Jan essentially repeated the three-minute Drake message over and over, tapping it out and blinking it in various wavelengths, in a pattern they would repeat in every environment: radio waves to microwaves through visible light to ultraviolet. They didn't go up into gamma or X-rays, which could be perceived as aggression.

In the original back-of-the-menu plan, they started with radio waves at a wavelength of one meter, and then went to a tenth of a meter, and then microwaves at one centimeter, and so forth, the seventh and eighth iterations being ultraviolet. But Jack pointed out that there was nothing special about the number ten, except for creatures who have ten tentacles or fingers, so to be nonprovincial about it they used 9.8696, pi squared, as the divisor.

The artifact tolerated Mars but didn't remark on it, so they pumped out the thin gruel of its atmosphere and substituted the hot vacuum of Mercury. A blazing artificial sun crawled across the sky while Jan's message patiently tapped and bleeped and blinked through the inferno, 600 degrees K, hot enough to melt lead.

But Mercury was a picnic spot compared to Venus. They stayed on the safe side of the blast wall and pumped in hot carbon dioxide, ninety atmospheres of it at 737 degrees K. As had been true with Mercury, the artifact's temperature rose at exactly the same rate as the ambient temperature. Its response to Jan's message was the same silence. They slowly brought the temperature and pressure

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back down to Samoan ambience, warm for North Americans if fatally frigid for Venusians.

Some wiring and components had been stressed too much, and it hadn't been easy on the human components, either. So they took a few days off while replacement parts were assembled and shipped from various countries, and everybody took a short vacation over on the more old-fashioned island Savai'i.

After you'd seen the famous blowholes, there wasn't a lot to do unless you were a surfer with a death wish, so they mostly walked around enjoying the peacefulness. Some of them watched or played cricket. Jan engaged an old woman to teach her how to paint the traditional siapo cloth, and she spent a couple of afternoons doing that, making souvenir placemats for her grandchildren while listening to the hypnotic ocean crash, sipping the local fruit juice, not thinking about much. Trying not to.

They stayed at the venerable Safua Hotel, which was actually just a bunch of cottages around a central fala, where a buffet feast was offered for supper and an automated bar served as a social focus.

There was no cube on the island, by law, so the evening entertainment was home-made. Russ and Naomi played chess while most of the others listened to a pick-up band of local kids who alternated modern music with traditional Samoan. They tried to teach everybody how to dance Samoan style, with little success except, surprisingly, Jack. He mumbled something about Hawaii when he was in the service.

After three days they got word that all the replacement equipment had arrived, and installation would be complete the next morning. So they took a light plane back to Apia—the ferry over having been a little rough for most of them—and with binoculars could occasionally see rays and sharks in the transparent water.

Muese, one of the native Samoan techs who had stayed behind, had dug a fire pit on the beach between the blast wall and the laboratory, and was roasting a pig, buried wrapped in taro leaves. He made a shallow pit in the afternoon and wrapped yams and potatoes in foil, and put a rack over the coals to grill chicken and fish.

Jack provided tubs of ice with drinks and a keg of beer, and invited all forty-eight employees of the project to the luau. There was no special reason to have a party, but no reason not to have one, either. Work would resume in earnest the next day.

Just before sundown, Muese dug up the pig and spent a half-hour carving it, while others tended to the chicken and slabs of tuna and masi masi. The automatic security floodlights came on, less romantic than guttering torches, but good light to cook and eat by.

After the sumptuous meal, a group got together by the fire with guitars, a harmonica, a fiddle, and a tin whistle, and played improbable Irish and Welsh music, popular in the States. Russ and Jan sat apart with a bottle of cold white Burgundy wrapped in a wet towel.

"So what happens next," Russ said, "if we get out to Jupiter and still don't have anything?"

She shrugged. "More invasive procedures, I suppose. Jack must have ideas. He's not committing himself."

Russ finished off his glass but didn't pour another. "He has more than ideas. He has an offer. From China."

"He didn't say anything."

"Yeah. I only know because I was in the office when the machine decrypted it. He couldn't tell me not to watch."

"Let me guess. They want to bury the thing in chop suey."

"Not even close. Chop suey's American, anyhow."

"I know. What is it?"

"They'll co-sponsor putting the artifact into orbit. Split the cost of a cluster of four Long March rockets."

"And once in orbit?"

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"Take the big laser up with it, I guess. Try it at a 100 percent, safely off Earth."

She shook her head. "Remind me to be somewhere else when it's overhead."

"I think he can be talked out of it. It would mean taking government money." He refilled both of their glasses. "We have to come up with something else, though."

She stared at the containment dome. "We could just send it into the future."

"First we build a time machine."

"I mean one day at a time. Just put a fence around it and wait for science to catch up with it." She took a sip, still staring. "Suspend the project for ten, fifty, a hundred years."

"Jack would die first."

She nodded. "As would we all."

31. Washington, D.C.—1974

The chameleon decided to stay in one place and make a fortune. It had been wealthy in the past, spoils of war, but it had never been a rich capitalist, which sounded interesting.

It kept the core identity of a man who went to the office every morning, did his administrative work like a good drone, and then went home to his bachelor apartment, presumably to watch TV and read. He seemed uninterested in women, and most of his coworkers thought he was gay.

What the chameleon actually did at night was become young and gay, in both senses of the word. It dropped ten or fifteen years and pounds, which it could do in a painless second, and exchanged the office uniform for something eye-catching but tasteful. Then it either went on a date or went trolling for a new source of money.

It had three wealthy men paying regular "gifts," for discretion as well as services rendered, and made even more per month by picking up men and robbing them after sex. If they fought, it would sometimes have to kill them, but usually the threat of exposure was enough. It preferred to leave them alive, so it could identify them months or years later for a repeat performance, with a different face and body. There was a gay "scene" in Washington in the seventies, and the chameleon moved through it like an invisible predator.

It didn't prefer gay sex to straight; one was much like the other. It made less money as a woman, though, and as a gay prostitute it ate at better restaurants, and the other man still picked up the bill.

The seventies and eighties were good for the stock market, at least for conservative investors, and all of the money the chameleon made from sex and extortion went straight to its broker. After the first million, it became a broker itself, handling its various identities under yet another false one.

It didn't have a plan, in the sense of ambition. It watched its various fortunes grow and shrink and grow again like a horticulturist tending a garden, fertilizing in one season and pruning in the next.

It slowly became the richest creature in the world, though the wealth was scattered among a hundred identities and a thousand accounts. It started two small wars, as experiments, and profited from both, though not as well as it did in drugs and dotcoms.

It left dotcoms a year before they tanked, but then, instead of pushing its advantage, left the money to marinate for a year or decade or two. Something would come along.

Maybe money could accomplish what research had not, finding another one like himself. Humans were no challenge to kill.

32. Melbourne, Australia—1997

The changeling settled into the Gippsland campus of Monash University in 1997, and spent four years earning a double degree in marine biology and biotechnology. It enjoyed Melbourne, but often spent its free time in the water, being a subject as well as a student

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of marine biology, and enjoying fresher fish than any sushi chef could offer.

Its academic performance was flawless, Monash being no more difficult than Harvard or MIT, and it accepted a full scholarship to James Cook University in Queensland, where it spent four years getting its M.S. and Ph.D. in marine biology, specializing (naturally enough) in "Behaviour of Marine Animals."

It took its fresh doctorate to AIMS, the Australian Institute of Marine Science, where it began researching "wonky holes," the fisherman's name for muddy holes that foul trawling nets near reefs. Many kilometers offshore, they turned out to be fresh water percolating from subterranean streams—a natural process that was having an unnatural effect on the reefs, because the water carried nutrients from farms, which fed algae, attracting fish. Fishermen kept the location of wonky holes secret, because they attracted schools of fish—an easy day's catch was worth the occasional fouled net.

Investigating this phenomenon gave the changeling its first opportunity to see itself as a great white shark. AIMS was using underwater videocams to monitor fish populations, and one weekend the changeling went out to visit a camera site. It grabbed the bait box, used to attract smaller fish, in its powerful jaws, and crunched it flat, thrashing around in a natural reaction to the strange metallic flavor. It made for some great footage, which had gone all over the oceanographers' world by the time the changeling had turned back into a human and returned to the lab. "Ugly customer," it said when it saw the tape, to predictable response: "No, it's *beautiful*, can't you see? It's just being a shark." Actually, it was engaging in unsharklike behavior at the time, analyzing the difference in the ocean's flavor around the wonky holes: slightly acidic fresh water. Bad for coral in the long run, though in the short run it was like an all-you-can-eat buffet for the small creatures that feed on algae and plankton, and the larger ones that feed on them, and on up the food chain to the fisherfolk who cursed the wonky holes for mucking up their nets, but kept returning.

In the long run, though, the wonky holes were one of several interlocking factors that were destroying the offshore parts of the Great Barrier Reef, which was bad for tourism as well as fishing. The changeling made them his specialty, and being a part-time shark gave him a huge advantage over other researchers: he could smell out wonky holes in the early stages of development, before they had attracted enough fish to draw the attention of humans. So he did "productive" analysis in reverse: he found relationships between fishing patterns near the shore and the formation of wonky holes, and scientifically predicted where to find the small ones.

This eventually led to a selective reforestation program—the excess percolation of fresh water was indirectly caused by the absence of trees, which would normally store large quantities of water after a rainfall, to harmlessly evaporate back into the clouds.

By this time its identity, as James "Jimmy" Coleridge, had been well established, a Californian who had adopted Australia with enthusiasm. At twenty-seven, Jimmy was considered quite a prodigy in the small world he'd mastered. James Cook University offered "the Wonky Hole Man" a tenure-track professorship, and the changeling took it with some enthusiasm, seeing it as a good platform from which to observe the overall situation of marine science in the Pacific.

Somewhere out here was the answer.

Young Dr. Coleridge was popular with his students, both the undergraduates in the general oceanography courses and the graduate students who worked with him in Special Problems in Marine Ecologies. It wooed and married one of its graduate students, Marcia, a

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beautiful blonde from Tasmania.

She dropped out of course work to become a faculty wife, a position for which she was not particularly well suited. She drew a lot of the wrong kind of attention from the faculty husbands, and obviously enjoyed it, flirting with more and more energy as her marriage failed to provide her with children—a reasonable enough ambition, but hard to realize if your husband has no gender and is not really human.

Moody and volatile, she became Jimmy's Tasmanian Devil, and it was inevitable that other men would try to tame her.

When she became pregnant in the spring of 2012, a lot of people suspected what her husband knew for sure.

The changeling didn't relish the prospect of complicating its life with children, so it was happier than most husbands would be when it turned out that the newborn's father was obviously of a different race. (How different, only Jimmy knew.) Some people admired the calm way he took it, and his magnanimity on giving her a no-fault divorce and blessing her remarriage to the only black man in their circle of friends. Other people thought it was a shameful abdication of his rights as a man. Even in Queensland, they wouldn't say "white man," but that's what many of them were thinking.

The scandal might have retarded his advance at JCU, so when an offer came for a full professorship at the University of Hawaii, Jimmy snapped it up like the hungry shark he used to be, on weekends.

The changeling decided to stay in the Jimmy Coleridge persona for awhile. Having studied and taught in Australia for seventeen years gave it a slightly exotic accent and manner, having honed its twenty-first century social skills in the tropical north. Jimmy was popular with the male faculty and students as a hale-fellow-well-met, who never got more than pleasantly tipsy but could drink anyone under the table. Of course to the changeling gin was as harmless as rocket fuel or hydrochloric acid.

Coleridge carried a respectable class load, with two graduate courses and a seminar as well as the large lecture class in Introductory Oceanography, which had room for 150 students and was always oversubscribed. He turned out papers with gratifying regularity, as well; between his social life and academic life, some wondered when he had time to sleep.

He pretended to sleep, of course, sometimes in the arms of a graduate student or young professor, which didn't harm his reputation. He wrote most of his papers in that mode, eyes closed and mind in high gear.

In the sixth year of his tenure, 2019, everything changed. Like everyone else, he read and saw the news about the strange artifact that the Poseidon Project had brought up from the Tonga Trench. Unlike most people, the changeling felt a shock of recognition.

It immediately got in touch with the Project, and hit an absolute wall: no hiring. Every position filled by people who'd been in it from the start. Thanks but no, thanks. You can read our published data and do your own work.

Of course the changeling knew they wouldn't publish all the data. They were in pursuit of profit, not knowledge.

For the first time in its life it considered revealing its true nature. Want a consultant who can *really* help you with aliens?

But not yet.

33. Apia, Samoa—30 May 2021

Europa, under its ice surface, was not too difficult. They considered not trying it at all, since the environment—cold saline solution under pressure—wasn't all that different from the Tonga Trench, where it evidently had been since approximately the dawn of time. Of course that also was a good argument *for* doing

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it. The artifact might respond to the familiar.

It showed no gratitude for Old Home Week, though, sitting as passively as ever, mirroring the ambient temperature but not otherwise acknowledging their efforts. It was a good test for the containment dome's integrity, which was going to be challenged by Jupiter, but otherwise did nothing other than raise the blood pressure of the observers along with the water pressure inside.

After Jan had finished her familiar algorithm, they depressurized and drained the dome, and prepared it for Io, the innermost of the four large moons, the Galilean satellites.

Io's atmosphere is exotic and variable, but thin almost to the point of being a vacuum. It can get up to about 100 nanobars and down to one (the air on the top of Mount Everest is 330 million nanobars). The fact that it's a poisonous mixture of sulfur dioxide and sodium isn't relevant to human survival; a human would freeze solid in the middle of explosive decompression, not having time to notice that the air smelled bad.

Still, it was possible that Io's surface conditions were not unusual in the universe, so they went ahead with the model, a frigid near-vacuum with a scattering of frozen sulfur dioxide on the floor. They varied the temperature from 100 degrees K to 130 degrees, enough for some of the sulfur dioxide to sublimate, and then fall back as snow.

The artifact faithfully mirrored the changes in temperature, but otherwise ignored the investigation.

It wasn't much of a change to simulate Pluto, just suck out the sulfur dioxide, lower the temperature to -233, and put in a dusting of snow: solidified nitrogen, methane, and carbon monoxide, with a squirt of ethane flavoring the nitrogen. To any Earth creature, it would be indistinguishable from Io, but conceivably might make all the difference in the world to you, if you were used to living on a snowball in Hell.

They used the space suits for the last time—that was a part of the deal, that they record the suits' performance in the various environments—and then sent them back to NASA. They would be no help for Jupiter.

For the other planets, they had simulated surface conditions. That wouldn't be possible on Jupiter. Theoretical models allowed the possibility of a rocky core, but you can't get there. As you descend through Jupiter's increasingly thick atmosphere, it becomes more like a star than a planet—the temperature coming to about 30,000 degrees and the pressure about 100 million atmospheres. It's "liquid metallic hydrogen" there, and if anything could live under those conditions, it was unlikely to find Earth interesting.

Jan decided to try two jovian regimes: the one deep enough into the atmosphere that it enjoyed the same air pressure as Earth at sea level, though the temperature was -100 degrees C, and the deeper one where the pressure was five atmospheres, but the temperature was an earthlike 0 degrees. In both cases the atmosphere was about 90 percent hydrogen, and the rest helium with a little spicing—methane, ammonia, ethane, acetylene.

In terms of temperature and pressure, it was a lot easier to handle than Venus. But carbon dioxide isn't flammable. She looked at the huge tanks of hydrogen waiting for the high-pressure phase and tried not to think of it as a fireball waiting to happen.

It was more than a thousand times the quantity of hydrogen that exploded in the Hindenberg disaster.

By now, most of the people, Jan included, had little hope that the artifact was going to respond to anything. When it did, they thought it was an experimental error.

The thing inside the artifact didn't think, not the way humans think. It did-

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n't pose problems and solve them. It didn't wonder about its place in the universe. It felt no real need to communicate.

Its mandate was survival, and it had powerful tools to that end. If the life that decorated the surface of this planet seemed to be a threat, it could simplify the situation. It had patience, fortunately, beyond any human reckoning of the term. All this tapping and zapping and flashing—it could stop the annoyance with one exercise of will, fry the planet clean.

But a central part of it was still out there. It could wait for its return. Maybe, it finally decided, speed up the return by tapping back.

When the changeling got off the plane at the Apia airport, the place was crazy with celebration, even though it was three in the morning. A couple of dozen young men and women danced and clapped and sang in harmony; bunting and flags were everywhere.

When it had boarded in Hawaii, it couldn't help noticing that several of the Caucasian passengers were unusually old. When the singing stopped, while it was waiting for its luggage, it found out what the story was. It was the eightieth anniversary of Samoa's independence, and these old guys were the last survivors of the American forces that had been stationed here in World War II.

Bataan came back in a rush of bad memory, while the mayor of Apia welcomed the old vets and told stories she'd heard from her father and grandfather. The changeling listened respectfully, its face revealing nothing.

It was a pretty face. The changeling had the form of a young attractive woman.

The ad it had answered on the net was looking for a laboratory technician who could operate this and that machine and had knowledge of marine biology and astronomy. It didn't call for doctorates in those subjects, but then the changeling could hardly advertise those. Its faked credentials were impressive enough; it only claimed "wide reading" in marine biology and a B.S. in astronomy. (The degree actually belonged to the woman whose appearance it had taken. Safely out of the job market herself, she was the mother of triplets in Pasadena.)

Putting together a fake identity was more complicated than it used to be. It was not particularly hard for the changeling to pretend to be the woman from Pasadena; it even had her fingerprints and tattoos and scent. But it had taken a bit of computer wizardry to erase the records of her husband and triplets and substitute an impressive job record. It had taken even more to temporarily make sure that computer, phone, and fax messages were routed through the changeling before Rae Archer got them.

The actual Rae Archer was beautiful, and took pains to look less than her thirty years. The changeling modified the details so that it was the same face, but merely pretty, and thirty.

It had done it all in less than a day, once the ad appeared on *Sky and Telescope*'s website. (It automatically monitored anything with the key words "Apia" or "Poseidon Project.") As Rae, it had talked to Naomi and then Jan, who agreed to give Ms. Archer an interview if she was willing to gamble the airfare out to Samoa and back. The changeling thought it had done a good job of imitating an excited young woman trying to contain her enthusiasm.

The real gamble, of course, was background checking. The changeling had inserted files attesting to Rae Archer's job competence in every position she'd held. But if Naomi or Jan decided to call the States and ask for an actual person's recollection of the woman's work, the web of deception would evaporate.

Apia was muggy and buggy at three in the morning. Almost every cab in town was waiting outside the airport—the

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plane from Honolulu only came in twice a week—but the changeling asked directions and did the sensible thing, taking the bus into town. It was twenty miles of slow driving either way. For an extra three dollars, the bus went a block out of its way and delivered the changeling to its door, a bed-and-breakfast just a kilometer up the beach from the Poseidon Project.

The proprietor was there, heavy-lidded but friendly, to show the changeling to its room. It feigned a couple of hours' sleep (while relaying four e-mails to the real Rae Archer and monitoring a wrong number) and then went out to watch the dawn come up over the mountains.

34. Apia—June 2021

The changeling suspected there might be some slowdown in things because of the anniversary, but it didn't expect an absolute rejection.

"Come back day after tomorrow," the guard with the phone said. "It might even be a week before anyone can see you." She asked why and he shook his head, listening to the receiver. "We'll reimburse you for your extra expenses." Listening again. "There's too much happening now. Just enjoy the town."

The changeling, of course, could clearly hear the other side of the conversation. The excitement in the woman's voice—it knew she was Naomi from the stateside calls—was palpable. It had obviously come one day too late. There had been some breakthrough.

It walked most of the mile into town, stopping at a souvenir store to buy some informal clothes and change out of its business attire. The clerk showed it how to tie a lava-lava dress, and it chose a matching blue shirt that it would have called Hawaiian in any other context. Gaudy earrings and a necklace of shells completed its camouflage.

Samoa had actually gained its independence on January 1st, but since that was already a holiday, they sensibly moved the celebration up to June. The changeling walked on into town in a resigned, almost grim, mood. Enjoy, enjoy.

It found all kinds of dancing and singing, which might have been more interesting to an actual human. Feasting, similarly irrelevant. Canoe and outrigger races and horses prancing through dressage routines.

The changeling used its simulated Americanness and feminine charm to get close to a couple of the vets, both slightly over a hundred years old.

One was surprisingly clear-headed and articulate, especially about war: he was against it. After WWII, he had fought in Korea and had no sympathy for it or Vietnam or the dozen smaller wars and fake wars that followed.

(His WWII assignment to Samoa had been a stroke of luck. The Japanese high command had at the last minute decided not to invade and occupy the Samoan Islands; the only contact with them in the whole war had been a long-distance burst of machinegun fire from a passing submarine, which hurt no one.)

He was unaware of the Poseidon Project, though he well remembered the submarine disaster that had provided a pretext for its beginning. Never would have happened if the god-damned fat cats had kept their mitts off Indonesia, a not uncommon opinion which had not kept the United States out of the current conflict there. As part of the international peace-keeping force, that is, which was 88 percent American and was conspicuously not keeping the peace.

The changeling having practiced its "pretty American girl" routine on the old man got her a holovision news spot. That didn't hurt her job prospects, as it turned out, because it happened to be aired at the time when the exhausted research team broke for dinner, and Jan recognized her name. Russ probably decided right then that he was going to hire her, just to brighten up the place.

The changeling walked all day exploring Apia, aware that it was far from a typical day. No race could play so hard

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and expect to survive.

The next morning it was again rebuffed; everyone was too busy for interviews. It went back to the B-and-B and spent the rest of the day searching the web, building a mosaic of such information as Poseidon had parsimoniously released, along with a wealth of rumors and speculation.

Some of the speculation was extremely bizarre, ascribing to Poseidon a CIA genesis, or even suggesting that they were all aliens, and had made up this ruse to slowly break the news to the human race.

The changeling was possibly the most intelligent reader who saw that one and wondered if it just might be true. In fact, though, it wasn't.

There were only two aliens on the island.

35. Pago Pago, American Samoa—June 2021

Apia was too local and too small for a killing spree, and the chameleon was getting bored. He left work a few minutes early and took a cab to the little Fagali'i Airport outside of town, and got on the 6:00 puddle-jumper over to American Samoa. The twelve-passenger plane had sixteen passengers, but four of them were children sitting on their mothers' laps. The flight was only forty minutes long, but forty long bouncing minutes locked up with crying and puking children could turn even a normal man's thoughts to violence. The chameleon distracted himself conjuring images of infanticides past.

It was still blistering hot at the Pago Pago airport, but worse in town: it had been a "bad tuna day." Almost half of the people in American Samoa work in one of the three tuna canneries; their malodorous waste goes into the harbor to compete with sewage for one's attention on hot, still days.

Darkness brought a breeze, though. The chameleon went down to the waterfront in search of trouble. The area east of the canneries, the Darkside, was where to find it. On his way down, he ducked into an alley and came out the other end looking like a rumpled Pakistani sailor.

The first couple of bars looked too quiet for fun, catering to the yachties who moored in the cesspool long enough to take on provisions—and perhaps avail themselves of the Darkside's cheap women and expensive drugs.

He heard a commotion and went into a dark dive called Goodbye Charlie's. Two tall and muscular Samoans were standing at the bar, yelling at each other in a couple of languages. The bartender watched them warily, evidently moving bottles and glasses out of reach. The other patrons were looking on with an air of detachment. It might be a regular evening diversion.

The chameleon took the only empty seat at the bar and waved a twenty. The bartender sidled over, not taking his eyes off the two. "Yeah?"

"I would like a Budweiser and an ounce of whisky," he said with a pronounced Pakistani accent. The bartender gave him a look and snatched the twenty away.

He came back with no change, a warm bottle of Bud, and a tumbler that had been rinsed but not cleaned. He poured a generous inch of liquor into it from a bottle without a label.

"Are those gentlemen twinking?" the chameleon asked.

"Tweaking? I guess." American Samoa's drug of choice was methamphetamine, ice. People coming off it get into a dark mood, sometimes argumentative and combative, "tweaking." It could lead to violence.

The chameleon drank the whisky in three gulps and slid off the stool. He walked unsteadily over to stand in front of the two sailors. "I say." They ignored him. "I *say*! Will you quiet down?"

"Yeah, right, fuck with 'em," a drunk American said into the sudden silence. The two looked blearily down at the lit-

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tle Pakistani, a foot shorter than them. One leaned forward and swung at him, an open-handed slap.

The chameleon ducked under the blow and grabbed the man's wrist and twisted, bringing him to his knees. He twisted harder and pulled, and the man's shoulder joint popped like a chicken leg coming off. He rolled down on the floor, keening in pain. The chameleon silenced him with two vicious head kicks. Bar stools crashed all around as most people backed away from the action. The drunk American stayed seated and applauded slowly.

"Tough little Paki," the other Samoan said, and produced a box-cutter from somewhere.

"Enough!" the bartender roared. "Take it outside!"

"Okay." The chameleon turned on his heel and walked toward the door.

Witnesses would later tell the police that whatever happened was too fast to follow. The Samoan touched the Pakistani on the shoulder, evidently, and he spun around.

The Pakistani handed the Samoan his box knife and said, "Ta." The Samoan stood up straight and looked at the scarlet stain spreading on the abdomen of his tee-shirt. Then loops of bluish blood-stained guts slid out, hanging to his knees, and he crumpled over dead.

No one saw the Pakistani leave. When they crowded out the door, there was no one there except an old man sitting on the pier, fishing with a handline.

In the morning, the police would find two prostitute's bodies in a dumpster. There were strangle marks on their necks, livid finger and thumb marks, but they'd died of cerebral hemorrhage, their heads beaten together.

The chameleon was gone by then, on the dawn flight to Apia, in a much improved mood.

36. Apia, Samoa—June 2021

The third morning was clear and calm, so the changeling took mouthgill and gear down to the Palolo Deep Marine Preserve, less than a kilometer down the road. It had formed a bathing suit around its body, modest by American standards, but also wore the lava-lava walking to the beach, so as not to offend the locals—who were all sleeping it off anyhow, except for the yawning young girl who took its money at the park entrance.

The tide was high. The changeling put on its unnecessary mask, mouthgill, and fins, and slipped into the familiar medium.

In the shallows between the shore and the reef, there was a scene of unearthly strangeness—a many-acre farm of giant clams, thousands of them, from a foot in diameter to the size of manhole covers and larger. There were smaller ones protected by enclosures of chicken wire; the changeling salivated at the thought of what they would taste like. It worked a small one out of its cage and, hardening its teeth, crunched down on it, delicious.

The reef was beautiful, a multicolor maze of living coral, but that wasn't the changeling's destination. It swam quickly beyond, out to where the waves crashed on the barrier reef that separated the island from the deeps. It cut through the strong swirling currents, found a jagged opening, and dove through.

It swam down through the cool stillness to the bottom, and stashed its equipment under a rock.

How fast could it change into a shark?

It took twelve pain-filled minutes, perhaps its fastest time. Halfway through, it was visited by a reef shark almost its size, which circled it a few times and nosed it, and apparently decided that whatever the strange thing was, you couldn't eat it or breed with it, and drifted away. Sea creatures did occasionally bite the changeling, but most of them immediately spit out the alien stuff.

It became a hammerhead for the good eyesight, and swam a couple of kilome-

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ters south, to visit the Poseidon Project. It was easy to find, following a metallic taste that was quite different from anything it had experienced before. It found the source easily, warm water coming out of a discharge tube; it evidently cooled the nuclear reactor that powered the place.

After a minute's search, it found the intake tube as well. That could come in handy. If you plugged it up, how long would it be before the reactor started to heat up and shut down? Or melt down.

It inspected the parts of the blast shield that were in reasonably deep water, not wanting to attract attention. A nine-foot-long hammerhead would be pretty conspicuous in shallow water. It could hear children splashing and swimming on the village side of the shield, and was tempted to give them something to tell their playmates about—just swim up and smile—but no, best not to do anything unusual, unsharklike.

It might be on camera, anyhow. Better act like a confused fish who just wandered in too close to shore. Hammerheads are curious and incautious.

As if in response to the thought, it heard a powerful motor roar into life and begin heading its way. It swam quickly for the depths.

Fast boat. It caught up with the changeling before it got out of the relative shallows. There was a loud *bang!* and a harpoon spiked completely through the shark body, just below its head.

The motor immediately throttled down, and someone began to haul in his prize. The changeling let itself be pulled halfway to the boat and then flexed a sudden 180 degrees—hammerheads are agile—and swam away at top speed.

At the end of the line there was a sudden tug; then a scream and splash. Just for fun, the changeling flexed again and sped back to the boat, only a little hampered by the harpoon. The man was still halfway in the water when the shark bumped into his foot, the immediate change in the water's flavor a testimony to how much he enjoyed the experience.

Someone aboard the boat started firing a large pistol into the shark, two hits and two misses. The changeling twisted under the boat and took a healthy bite of fiberglass hull, and then headed at top speed for deep water. Once safely out of sight, it stopped the dramatic but unnecessary bleeding, and temporarily enlarged the first wound so that the harpoon could slide out easily. Then it swam north, staying comfortably deep.

It wondered whether the men had been motivated by fear or greed. Probably greed; with the harpoon and gun, they were set up for shark fishing. Its fins would make several thousand dollars' worth of soup, which was why there weren't many large sharks in the area, despite the abundance of food.

The mask, snorkel, and fins were still safe under the rock. It took only ten minutes of pain to change back into the young woman, and another thirty seconds to secrete the bathing suit material. It was an imperceptible half-inch shorter because of the loss of material to the woundings. It would catch and absorb a couple of reef fish on the way back.

It was interrupted in that simple task. It had chased and caught a large snapper, and was enlarging an orifice to absorb it, when it heard a human voice.

The ticket-taking girl was about a hundred meters away, at the edge of the reef, shouting and gesticulating. It let the snapper go and relaxed the orifice to its usual size and let the bathing suit cover it. It swam toward her as a human might, relaxed on its back, with the mask pulled up to its forehead.

"You are Mrs. Rae?" the girl said.

"Rae Archer," the changeling said, standing up in the meter of water.

"Mr. Wade thought you were here." The man who owned the B-and-B. "He said the Project people called for you and they want you to come at eleven. It's almost ten."

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Time flies when you're having fun. "Thank you. I'd better hurry, then." The changeling kept its swimming speed down to that of an athletic human and then waded ashore with convincing clumsiness, in its fins. It could have taken them off, but it knew the pebbles were too sharp for human comfort. It retrieved lava-lava and sandals and jogged back to the B-and-B.

It took a cold shower and shampooed quickly, though it could have done a better job on its skin surfaces and hair just by sitting alone for twenty seconds. It put on tropical office clothes and let Mr. Wade drive "her" to Poseidon, though she could have walked and been on time.

But if she had done that and shown up not sweaty and flushed, someone might wonder.

Outside the Poseidon gate, two men had a light fishing boat up on two sawhorses, showing a crowd of gawking kids the shark bite near the bow.

A large muscular woman, Naomi, met her at the door, but instead of going inside, led her back down the road to Cottage 7. They left their shoes at the door, along with two other pair, and went into the air conditioning.

At a wooden table, a man and woman in fit middle age. The woman looked familiar. Some pieces fell into place and the changeling remembered it had graded her papers at Harvard, back in 1980.

It shook his hand, Russell Sutton, and he introduced it to its former student, Dr. Jan Dagmar. They both looked hollow-eyed and wired, as if they'd done a couple of all-nighters on pills and coffee. They sat down heavily.

"Coffee?" Naomi asked, and the changeling said yes, black, and sat down across from Jan.

"First, tell us what you know about the project," Jan said.

"That would take a while," the changeling said. "I've done my homework." Jan shrugged in a friendly way.

It accepted the coffee. "Thanks. You stumbled onto this undersea artifact and salvaged it, and soon found that it was made of some substance too dense to find a place on the periodic table. Three times as dense as plutonium, but not radioactive."

"Three times if it's solid," he said. "It's probably hollow."

The changeling nodded. "If it's from Earth, it was made by some process we don't understand—putting it mildly! Likewise, if it was made on some other planet. We still don't know how it might have been made, but it's intellectually less uncomfortable to assume it came from somewhere else."

"Which is what piqued your interest," Russ said.

"Me and seven billion others," it said. "Ever since your announcement, my computer opens up every morning with a search for new material with the word 'Poseidon.'"

It sipped its coffee. "You haven't been able to drill or file so much as a molecule off this thing. You tried to boil some off with a laser and . . . there was an accident."

"You know what happened then?"

"No. I saw the CNN pictures and read the popular press speculations. The thing can levitate?"

He raised an eyebrow. "We saw the pictures, too."

"But you haven't published anything about it."

"No." He looked at Jan and back at the young woman. "We can tell you a little more if you're hired and sign the nondisclosure form."

"But only a little more," Jan said. "There's not that much to tell."

"You got a bachelor's in astronomy," Russ said, "and then you quit?"

"Marriage," the changeling said, "and when it didn't work out, he left me with too much debt for me to go back to being a student." This was a part of its autobiography that would stand up to computer search, but not much beyond that. The "husband" had conveniently

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dropped off the map, and its state and federal tax forms were precisely hacked, as were employment records for the two low-level lab technician jobs.

It had gone to some trouble to find two Los Angeles firms that were so large and mobile that Rae might credibly not be remembered personally.

"I did some checking," Naomi said. "Your professors at Berkeley had a high opinion of you."

The changeling gave her a level gaze. "And they wondered why I hadn't gone on."

"And why you became a lab tech."

"I had the training, from summer jobs. There aren't any jobs in astronomy."

"That's for sure," Jan said. "More than half the Ph.D.s are doing something unrelated to astronomy."

"I knew that when I chose the major," the changeling said. "My advisor advised me to learn how to flip hamburgers."

Jan laughed. "That's what my advisor told *me*, back in the eighties. So there's always hope."

"Do you plan to go back?" Russ asked. Under the circumstances, a question with no right answer.

"I keep up my reading at the library, *A.J.* and *Aph.J.*," it said carefully. "My interest in astronomy is undiminished, especially globular clusters and star formation." It realized it was sounding too much like a college professor, but it had *been* a professor a lot longer than it had been a lab technician. Or a dwarf or a prostitute, for that matter. "But it would be hard to go back to being a student. I've been a working woman for too long." Thirty-one of the past ninety-four years, if being a female shark counts.

"The SETI aspect of working here fascinates me," it continued. "I never had any course work in it, except as part of radio astronomy. So it would be interesting as a learning experience, even if nothing ever comes of it."

He nodded and exchanged another look with Jan. "You know what we've been doing the past couple of months."

"The planetary environments thing. I saw the *Nova* show about Venus; that was incredible."

"Well . . ." Russ put his fingertips together and tapped twice. "This is secret. The whole world will know before long, but we're still sorting out what to say, the timing. You can keep a secret."

"Absolutely."

"We got a response from the artifact."

The changeling articulated a variety of physiological reflexes, which for a change reflected its actual state: pupils dilating, sweat popping, a sharp intake of breath: "During the Jupiter simulation?"

Jan nodded. "Jupiter. At first we thought it was just a glitch. You know we use pi squared as the factor from one frequency to the next?"

"Yes; that was interesting."

"What the artifact did was repeat the message, the first half of it, but at *ten* times the frequency."

The changeling nodded. "So it knows digits."

"It may know how many digits *we* have," Russ said.

"At first we thought it was a transmission mistake," Jan said. "It was the acoustic phase, tapping out the message. It's done automatically, with a small solenoid-driven hammer. The response, ten times faster, was in the middle of our stock message."

"It was recorded but initially ignored," Russ said. "One of the techs, Muese, was analyzing it as a kind of feedback noise—that's happened before—and then realized it had to have come from the artifact."

"We were up in the infrared by then," Jan said, indicating a distance with one hand over the other, "but we went back to the acoustic mode, returning the faster signal it had sent. It responded with a long burst, twelve minutes."

"Saying?"

Russ shook his head. "We don't have the faintest. Not a clue. It seems random."

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They seemed calm, but the changeling could hear their pulses. Jan spoke carefully. "You'd think an intelligent creature, an intelligence of some kind, would respond in the same code." She looked at the pretty woman with a studied casualness that said *this is a test*. "Why do you suppose it didn't?"

The changeling paused longer than it needed. "One, Occam's Razor: it didn't understand that the first series was a code. It was just being like a Mynah bird. Then the second 'message' really was random noise. The factor of ten is interesting, but maybe it, or whatever manufactured it, had ten appendages.

"Two, maybe it's testing us. Maybe it made up its own version of the Drake message."

"We hoped for that," Russ said, "but it doesn't meet the first requirement: the two primes that would tell us the proportions of the information matrix."

"We did the obvious," Jan said, still testing.

The changeling stared at her. "Assumed the matrix would be the same size as yours, or the product of two other primes. But that didn't work."

Jan nodded and leaned forward, elbows on the table. "You know, this organization is only weakly hierarchical. That is, Russ and Jack Halliburton call the shots; direct and define what the rest of us are going to do. At the working level, well, it's pretty chaotic. That's the way we want it.

"This isn't like some R&D enterprise, where you can assign duties and work to a timetable. We're all wandering in the dark, in a sense, going on intuition.

"Even old people like Russ and me know that education and experience can get in the way of intuition. When we hire people at your level, it's with the understanding that, although much of your work will be routine, there's always room for your input. The woman you may replace was always coming up with off-the-wall ideas, and sometimes they were helpful."

"Why did she leave?" the changeling asked.

"Illness in the family, her daughter. She might be back once things settle down, but it looks like a long watch."

"Meanwhile, we need someone like you," Russ said. "You're not likely to . . . this is embarrassing. But the woman *she* replaced had to leave to have a baby."

"I can't have children," the changeling said, not adding *except by fission*. It reddened and touched its lips.

"We didn't mean to pry," Jan said, giving Russ a sharp look.

"Of course not, no." He looked like a man who desperately needed some papers to shuffle through. Instead, he studied the inside of his empty coffee cup.

"Oh, I'm not sensitive about it," the changeling said. "It's only biology. Simplifies my life.

"If I do get the job, what would the job be, at this stage? It doesn't sound like gas chromatography or spectroscopy are on the menu right now."

"Not now, not anymore." Russ took the cup over to the coffee urn and filled it. "Your CV mentioned cryptography."

"One course and some reading." A lot more, actually, in another life. When it had studied computer science at MIT, everyone was interested in it.

Jan tapped twice on her notebook and studied the screen. "It's not on your transcript."

"I just sat in. My advisor vetoed it as frivolous. She would've killed me if she'd known I was doing that rather than advanced differential equations."

"Been there," Jan said.

"Might have been a lucky choice," Russ said. "It's what you'll be doing for awhile, I think.

"With this pesky data string from the artifact, we're dividing into two groups. One, the one you'd be in, will try to decipher the message. The other's keeping after the artifact with a series of more complex messages, along the lines of the first one. That'll be Jan's group."

"You're keeping it in house? Keeping

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the government out?"

"Absolutely. We're a profit-making corporation, and there just might be an obscene profit in whatever this thing has to say. Better be, to justify what Jack's sunk into it."

"If we were in the States," Jan said, "the government might be able to step in on grounds of national security. But there's not much they can do here. Jack's even a Samoan citizen."

"You do have a NASA team," the changeling said.

"And we used NASA space suits, and they got us the use of the military laser that made things so interesting a couple of months ago. But our agreements with them are carefully drawn up, and the deal with the individual employees, well, it's kind of mercenary."

"It gives them all a cut of the profits if everyone behaves," Russ said, "and nobody gets anything if anyone leaks anything. Not to mention the pack of lawyers that will descend to worry the flesh off his bones and then crack the bones."

"Something like that will be in your non-disclosure statement, too. Jack is fair, I think, but not flexible." Jan tapped on her notebook again. "Obviously, I think you're hired. Have to pass it by Jack, who crashed a few hours ago and probably won't be making decisions until tomorrow morning. But the two of us and Naomi really do all the tech and administrative hires."

"So I just stay by the phone?"

Russ shook his head. "It's not that big an island. We'll find you."

"You can run, but you can't hide," Naomi said, and smiled. ■

To be concluded

Absolute freedom of the press to discuss public questions is a foundation stone of American liberty

—Herbert Hoover

If a little knowledge is dangerous, where is the man who has so much as to be out of danger?

—Thomas Huxley

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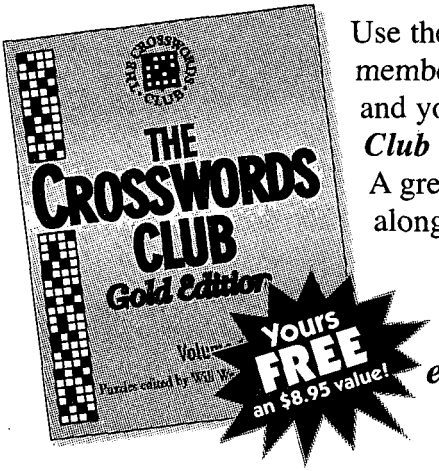

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The Companions, Sheri S. Tepper, EOS (HarperCollins), $25.95, 452 pp. (ISBN: 0-06-053821-X).

Skyfall, Catherine Asaro, TOR, $24.95, 319 pp. (ISBN: 0-765-30638-7).

Tinker, Wen Spencer, Baen, $21.95, 352 pp. (ISBN: 0-7434-7165-2).

Mockymen, Ian Watson, Golden Gryphon Press, $26.95, 325 pp. (ISBN: 1-930846-21-5).

The Dark Ascent, Walter H. Hunt, TOR, $?, ? pp. (ISBN: . . .).

That Darn Squid God, Nick Pollotta and James Clay, Wildside Press, $?, ? pp. (ISBN: 1-59224-097-6).

Tolkien: A Cultural Phenomenon, Brian Rosebury, Palgrave Macmillan, $19.95, 304 pp. (ISBN: 1-4039-1263-7).

I'm not a dog-lover. I find cats more congenial and certainly easier to manage when going away for a weekend. But by the time you read this, I'll be married to a woman who is definitely a dog lover. She keeps greyhounds! (As well as a bearded dragon lizard, a cockatiel, and a parakeet). And as any greyhound lover will tell you, they're a lot like cats. They don't have sense enough to use a litter box, but they shed, they sleep a lot, they have a sort of purr (they chatter their teeth), and they make great companions.

Which is all by way of leading into Sheri Tepper's latest, **The Companions**. The Earth Tepper portrays is a sad place. It is so overcrowded—thanks in part to a Law of Return that lets Earth's colonies among the stars ship all their retirees home—that the iggy-huffos ("In God's Image: Humanity First and Only!") can say with a straight face that all nonhuman animal life must go in order to leave more air and food and water for those made in God's One True Image. Wild animals are already gone. No elephants, no deer, no birds, no fish. Soon will come the edict sentencing all pets to death.

But first . . . Jewel Delis is the protagonist. Her mother once discovered on Mars a cavern containing the bones of humans and dogs, much, much older than any anthropological, archeological, or genetic evidence of the human-dog partnership, with art and inscriptions in the tongue of an ancient alien species. She was able to translate it with the aid of alien scholars. Then she sickened with a strange virus and died. Jewel's brother is an extraordinarily obnoxious twit with a genius for linguistics; he is often engaged to figure out the languages of new alien species. Jewel herself . . . well, she ran into dogs some years back and soon found herself working with the arkists, who are trying desperately to save all of Earth's creatures they can, buying worlds of little value, terraforming them, and settling birds and mice and so on in new homes. Serving as her brother's assistant and whipping girl, she has also proved unusually observant,

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making personal contact with the Phaina through her willingness to engage the living world, and earning a role as a spy for Gainor Brandt, head of the Exploration and Survey Corps.

She also married an upper-crust Mama's boy. When Mama found out, she was livid. Jewel was *not* good enough! So sonny was shipped off on a survey crew to a new world, Jungle, where he promptly vanished. Jungle was one of three living worlds in its system. Another, Moss, proved to have an apparent native species with a tendency to dance in front of the explorers' camp. A message scrawled on bark has appeared. There is a linguistics problem to be solved, and who better to hire than. . . ?

Right. Jewel and her brother soon arrive. With Jewel is a corps of gengineered dogs, able to talk. And before long she uncovers several vast and ancient conspiracies that threaten not just humans but every intelligent species in the galaxy.

The heart of the problem is that the iggy-huffo attitude—Us Only!—is by no means uniquely human. Intelligence and egotism seem to go together as a sort of species-level solipsism. Yet some species get past that to a life-engaging wisdom. They value and protect biodiversity, and they value and protect those members of younger species who share that wisdom.

So those of us who take animals—such as greyhounds—as companions are wiser and larger of spirit than those who don't.

I knew that.

That's why I'm marrying milady.

Catherine Asaro returns to the roots of the conflict between the Skolian Imperialate and the Eubian Concord with **Skyfall**.

Not that she goes all the way back to 4000 BC, when aliens abducted humans to the world of Raylicon, nor to the era (3600-2800 BC) of the star-spanning Ruby Empire and its marvelous psibernetic technology, nor even to the time when the Ralicons regained interstellar technology and built a new empire under the leadership of the ancient Ruby Dynasty—noble telepaths and empaths all—nor yet to the time (1866) of the Rhon gengineering project that created the variant-Ruby monsters who found joy in the sufferings of empaths and created the Eubian Concord or Trader Empire most of whose citizens were property. The saga Asaro has been telling over the last few years (*The Last Hawk, Primary Inversion, The Radiant Seas, Ascendant Sun, Sperical Harmonic, The Quantum Rose, The Moon's Shadow, Catch the Lightning*, and the forthcoming *Triad*) has centered on the Ruby clan that alone can operate the psiberweb and nominally leads the Imperialate, but in actuality is ruthlessly manipulated by a more-or-less democratic Assembly. The background has been an ongoing war with the Traders and the interplay of loves and marriages and children that must end in some sort of rapprochement. That war had a beginning, when the Skolians and Traders faced off over the Platinum sector, rich in ore essential to both civilizations, and in *Skyfall*, the Assembly is facing a vote on whether to go to war.

Roca, daughter of the Imperialate's founder, mother of Kurj, a powerful warlord who craves the war and will stop at little to achieve his end, and herself the Minister of Foreign Affairs, plans to be present to cast a deciding vote against the war. But she finds that she has been decoyed into a situation that will keep her away. Desperate to return, she maneuvers a ride to the world of Skyfall, where she plans to hop another ship in a couple of days. But when the local chieftain or Bard Eldrinson Valdoria appears, her Ruby empath's mind reacts profoundly. When he swoops her onto his steed and gallops off to his castle in the mountains, she protests but feebly, though she does extract his promise to get her back to the port in

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time.

Alas, a blizzard closes the trail. She is stuck in the arms of a man who, she soon realizes, has all the appearance of being a Ruby descendant and a very fit mate for a woman of the Skolian ruling clan. While the romance proceeds apace, politics rage on. Kurj gets his vote, even as he searches desperately for any hint of where his missing mother has disappeared to. Troops appear outside Eldrinson's castle; he has a rival who wishes nothing more than his death. And finally . . .

Kurj finds his hint. Tragedy seems imminent. Roca and Eldrinson must separate forever! But Asaro is an old hand at romance. Everything *must* work out.

Besides, readers familiar with the series *know* everything did. The pleasure is in the details, and there is a great deal here to please those readers.

It's got elves and magic and ley lines, but it feels more like SF and it's a fast-paced, sexy Pittsburgh adventure.

As Wen Spencer's **Tinker** opens, ratty, eighteen-year-old hypergenius Tinker is shuffling wrecks around her scrapyard. Suddenly a pack of wargs chases an elf over the fence, and when she has finished off the monsters—which turn out to be foo dogs in disguise—she recognizes the badly injured elf as Windwolf, whom she saved once before and who said there was a life debt between them. Unfortunately, the power's off—it happens once a month, when Pittsburgh bounces from Elf-land back to Earth for a day—and she can't call for help. Fortunately—remember, she's a hypergenius—she has devised a storage battery for magic and has just enough on tap to power a healing spell until she can get him to the elven medics at the end of the day.

What's going on? Well, here comes a pack of red-headed thugs out to kill Tinker. A highway pile-up reveals a mysterious smuggling operation—truckloads of high-tech gadgetry! The NSA reveals that scientists who understand the gate science are vanishing and/or dying. A recovered Windwolf says he likes her a whole lot and would she willingly accept this gift? When she naively accepts, he kisses her forehead, leaving his mark, and before long he is running a powerful, intricate spell, culminating with a passionate deflowering, that turns her into an elf. A high-caste one, too, for Windwolf is the local viceroy.

What has she gotten herself into? Does Windwolf think they're married now? Well, "Doh!" as Spencer has her characters say from time to time. And now here come the thugs again . . .

But . . . Pittsburgh? How the heck did Pittsburgh wind up in Elf-land? Blame it on Tinker's dad, who devised an interdimensional gate only to be murdered and have the plans stolen. Somehow—and Spencer tells you how—the plans wound up in China, which put a gate in orbit over the South China Sea. Pittsburgh was a side-effect, and the bouncing between Earth and Elf-land was the result of an agreement to turn the gate off for one day a month.

Remember that Tinker's a hypergenius. She recently applied to college, and the entrance exams revealed that she could understand the quantum theory behind the gate. She might even be "hyper" enough to duplicate Dad's work. The gate is interdimensional, so Elf-land is a parallel world, surely one of many. The oriental equivalents of elves are the demonic—and red-headed—oni. And there you have the basic elements.

Spencer got off to a great start with the Ukiah Oregon series. Her fans will be happy with this one too.

Ian Watson's **Mockymen** is both interesting and offbeat, and you're likely to enjoy it. It begins in Watson's own England, where a young couple in the business of making specialty jigsaw puzzles is approached by an elderly Norwegian, Knut Alver, to visit the Vigelund sculpture park in Oslo, photograph them-

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selves pressed nude against the statues, and make puzzles of the photos. A thoroughly curious gig, but money is money, even if it does turn out to have a lot to do with Nazis, magic, and induced reincarnation.

The puzzle-makers are out of the story by page 72, when Watson leaps into a future some years after aliens have reached Earth with gifts to bail folks out of ecological and economic crises. Food factories now churn out pap for the masses, and a new drug—Bliss—is available to all, though some of those who take it lose their minds after a year. But that's okay, because the aliens need mindless folks to accept downloads. They also need masochists to ride the interstellar transmitter as couriers, carrying in their heads the downloads safely protected from transmission agony.

Meet Anna Sharman, an intelligence analyst who is among the few who suspects the aliens may be up to no good. Jamie Taylor comes to her attention when, after his year on Bliss, he seems to lose his mind—but then he wakes up, just fine, thank you. He's a serious anomaly. Turns out he was born to the female half of the jigsaw duo, tortured while still a baby for "the number," and taken away for adoption.

The number? Remember Knut Alver and the notion of induced reincarnation. Maybe a Swiss bank account? Hmm . . .

The poor boy didn't have a clue, not as a baby and not later. But when an alien shows up with a gadget which, if you stare into it, awakens memories . . . The alien also has a story that amply confirms all suspicions of nefarious secret agendas. The next step is a risky attempt to learn more, and then to find a solution, preferably one that keeps the benefits the aliens brought with them while warding off any possible disaster.

The biggest problem with the book is that Watson here mixes some very disparate elements from science fiction and fantasy. Some readers may feel that the mix just does not work. I admit that it strains the famous "suspension of disbelief," but the tale has enough momentum and Watson is an old hand at bringing the unlikely to life. Overall, he makes it work very nicely.

Fans of Walter H. Hunt's *The Dark Wing* and *The Dark Path* space opera epic will be delighted to see **The Dark Ascent**. However, those who have not read the earlier books will not find this one welcoming; there is just too much that has gone before.

Recall that humanity's space empire fought the belligerent zor to a standstill, found a footing in the zor mythology, established alliance and a degree of mutual understanding, provided a human bearer for the zor sword of state, the gyarhu, and lost both gyaryu and Gyaryu'har to the shapeshifting, insectile, mind-warping vuhl. But then Jacqueline Laperriere rose to play the role of Qu'u, a figure out of zor legend, in the quest to climb the Perilous Stair, recover the gyaryu, and preserve both humans and zors from the forces of darkness, the esGa'uYal.

Now, as the forces of Light and Right learn to fight back against the vuhl, the mysterious Stone (the one-time aide to Admiral Marais who walked away from a ship in jump) makes it easy for Laperriere to recover the gyaryu, hints that the zor myths are not what they seem, and indicates that something else entirely is going on. Laperriere starts digging into the legends, finds that the originals are rather different, and discovers that the vuhl are not the esGa'uYal at all. That is something else, so far unknown, and even though she has the gyaryu in her hand, she is nowhere near the top of the Perilous Stair.

As Laperriere acts out the legend of Qu'u, she also acts out as a sort of moral that we must each face our demons alone. Yet on the larger scale, the moral is that there is strength in numbers. Humans have allied with zor to face their shared demons, the vuhl, once thought to be the esGa'uYal. Now we know that

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the vuhl share the same enemy. Will volume 4 turn the vuhl into allies? Will Hunt reveal the face of the esGa'uYal and tell us how they can be so deeply embedded in the zor spirit/dream world? Will volume 4 even be the end of the tale? Wait and see.

If you enjoy send-ups of the classics, try **That Darn Squid God**, wherein Nick Pollotta and James Clay introduce the hair-brained Professor Felix Einstein as he prowls the London fog with a mummified tarantula as his evil-alarm. Stopping in at the Explorer's Club to find Lord Benjamin Carstairs getting the hoot for his claim that a desiccated toy boat is Noah's ark, the Professor adds water. While the assembled explorers gawk, the vessel hydrates and swells alarmingly. And then Felix and Ben are off in hot pursuit of the Dutarian squid god, a bloodthirsty demon that is about to be reborn to the detriment of the human world. Romantic interest is added by the Professor's lovely niece Mary, who is the curator of the Prof's International British Museum for Stolen Antiquities.

So here we have the basic elements: the end of the world at hand, a horde of squid-worshipping villains to lay murderous traps in the way of the plot, a mad professor, a cute niece, and a doughty hero, and the last two *of course* fall for each other instantly. But Mary is no simpering frail; she's also quite doughty and plucky enough, and though she remains at home while the guys hare off in search of the squid god's temple and birthing ground, hoping to queer the demonic pitch, she will lead the defense of the museum when things turn dicey a bit later on.

"Dicey" is hardly the word for it. Before Pollotta and Clay are done, literary history will be rewritten (Wells' Martians actually came from Venus, for one thing), Baker Street will lose its most famous resident, a molluscan blitz will give London a spot of urban renewal, the Man-in-the-Moon will get a face-lift, and the Ladies Auxiliary of the Explorer's Club will convince you that it is wiser never to deny the supremacy of British womanhood.

I have enough gray hair to remember well when *The Lord of the Rings* was new. Wildly popular, it created the modern fantasy genre as publishers and writers hopped on the bandwagon, some with quite slavish imitations. It also earned derisive sneers from academia, much as had SF for many decades (it was much too popular to be literature!), but with a little something extra because Tolkien was a quite distinguished academic himself.

As a phenomenon, LOTR posed an interesting question. The new fantasy genre did well enough, as did the careers of some authors, but no single work came close to matching LOTR in popularity. Most of the imitations are deservedly forgotten. Why did LOTR only gain more readers with the years? How on Middle-Earth could it spawn the shelf full of drafts, notes, partials, ancillaries, and so on that gave Tolkien's son Christopher a career? Why a BBC radio adaptation, the Bakshi movie, and now Peter Jackson's film trilogy?

Brian Rosebury attempted to address such questions in 1992, when **Tolkien: A Cultural Phenomenon** first appeared. Now, with the first two Jackson films fresh in memory, he returns with a revised and expanded discussion. In brief, he says that Tolkien addressed his material in a mode much like that of the realistic novel, with such a wealth of carefully imagined, realistic detail that his world and characters came alive for the readers. He quite explicitly did not try to allegorize the modern world or current events, but nonetheless he provided numerous resonances with myth and history.

Rosebury's focus is almost entirely on the textual analysis and style of LOTR. He notes the role of World War I as a

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motivating force for Tolkien and insists that there was no attempt to mirror Hitler and Stalin (among others) in Sauron. Yet, even so, there had to be a powerful resonance for the reader in any tale that involved world-threatening evil (Sauron) while the newspapers were full of similar evils and everyone on Earth lived as much under the threat of devastation as any resident of Middle-Earth. One need not insist that Tolkien put that resonance in LOTR deliberately in order to see a foundation for LOTR's enduring popularity. Of course, if this were the whole of it, we might expect that popularity to have waned after the end of the Cold War. Terrorism, as frightening as it is, is hardly a threat of the same order. Thus much of LOTR's popularity must hinge on such things as the opposition of a benign, rural world, rich in Nature, with elementals such as Tom Bombadil still there to be met, with a malign, military-industrial world, rich in smokestacks and poor in Nature.

Part of the benignity of Tolkien's world, notes Rosebury, is the marked tolerance for diversity of opinion, peoples, and customs. This is an essentially liberal viewpoint, which makes me wonder why conservatives do not inveigh against LOTR as much as some do against Harry Potter (Horrors! It teaches witchcraft!). Another aspect of the benignity is Tolkien's placing of virtue in creativity and responsibility, such that evil lies in treating "created things and persons as 'machines.'" This too resonates for the modern reader—whether liberal or conservative—who may feel trapped in a web of limiting rules and regulations.

Rosebury also considers what some of the critics have had to say about LOTR, and he does not spare the rod. Some of those critics have displayed remarkable ignorance and carelessness!

An interesting take on the Tolkien phenomenon. For hard-core fans and academics. ■

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BRASS TACKS

Mr. Schmidt,

In your October editorial, "Scarce Skills And Scattered Substitutes," you left out an important concept when discussing transposing instruments. Although it can be convenient for a player to switch to an instrument of differing transposition in order to end up playing in an "easier" key, this is not the reason transposing instruments exist.

Instruments are built in families which include members of various sizes, in order to make a large range of notes available. (Bigger instruments play lower, smaller instruments play higher.) This is why an assortment of sizes came to be produced.

The reason transposing instruments are not written at "concert" pitch is directly a result of the physics of the instrument in question. Instruments have built-in quirks and compromises of intonation, tone, and facility of operation, which are all dependant upon the key center around which the instrument is engineered. With comparatively insignificant differences, the various sizes within each family respond quite similarly to each other on the "same" (fingered) note, as it relates to the instrument (not "concert pitch"). In other words, due to the physics of the construction of the instrument, there is actually a built-in bias which determines which note is labeled A, B, C, etc. In order to successfully play an instrument, it is important that the player be aware of the notes he is playing, as they relate to the physics of the actual instrument. The convenience of switching instruments to play in "easier" keys is not just a happenstance of notation, but a concrete reality of physics.

There are, of course, exceptions. A case could be made for the viola to be a transposing version of the violin, except that, in the absence of frets, the built-in bias toward a certain key is minimal, and the instrument can thus be written as it sounds.

The recorder family is saddled with the handicap of an ill-advised, long-standing tradition of being written non-transposing, therefore creating an obstacle for the player. This is because the family is so old that the tradition predates the popularization of transposed notation.

Chris Dierl

Your reasoning certainly applies to families like the saxophones and the valved brasses—but so does mine. They're built in a wide range of sizes to make a wide range of notes (and tone qualities) available, and they do have "favored" notes based on their physics. However, though neither of us was around when the decisions were made, I'm reasonably confident that the decision to call a centrally favored note "C" on all of them and write them as transposing instruments had a lot to do with the fact that that makes it easier for a single player to play any member of the family without having to learn new fingerings.

You're quite right about recorders, but it's only a handicap for players who learn the traditional way and haven't already learned to transpose for other reasons. I've never bothered

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to learn more than one set of recorder fingering; since I'd become quite comfortable with transposition long before I took up recorders, I just learned one set of fingerings and when I play one of the others, I just read it as an appropriately transposing instrument.

And there are a few cases where the "large range of notes" argument doesn't apply, including the one I mentioned in the editorial. The difference in range between A and B-flat clarinets is almost insignificant, but the difference in ease of fingerings in certain keys is dramatic.

Hello Dr. Schmidt,

I was very pleased to read the new story "The Cookie Monster" by Vernor Vinge in the October issue. I have wondered before about the question "What would I do if I were stuck in a personality upload/virtual reality situation?" One possible answer has to do with how accurately the physical laws of this virtual world reflect those of the real world. Here's a simple experiment that anyone can perform: wear polarized sunglasses and look at the sky on a clear day. Sunlight scattered from the air is partially polarized, so the brightness will look different depending on which way one is looking and the angle of the head. Another idea would be to shine a laser beam (and laser pointers are extremely common these days) on any object. A close look at the beam spot will show a pattern of light and dark dots. These dots are an interference pattern which will change as you move your head. Any virtual reality that can simulate physics on that level can only be described as pretty darn good.

I am sure that there are many more experiments in this vein. Others with specializations in chemistry, biology, meteorology, and so on, could think up tests anyone could perform. It is tempting to write a "Virtual Reality Survival Handbook."

I hope we will be reading more Vernor Vinge soon!

Benjamin Alan Weaver
Berkeley, CA

The author replies . . .

That would be a very interesting survival handbook!

I don't think Gerry's scam has super depth of detail. However, it may be somewhat resilient to such experiments, depending on how the participants' consciousness' are entangled with the background detail. (Of course, if I push that possibility too far, it would be impossible to do much new thinking in the simulation at all, since things would always come out per expectations.)

Dear Dr. Schmidt & Mr. Vinge:

On first reading "The Cookie Monster" (*Analog*, Oct. '03), I wondered why Victor, Professor Reich's spy, simply doesn't delete the e-mail to Dixie Mae that sets her in motion and "contains more clues than a bad detective novel" to finding allies and discovering the fresh-upload-every-cycle VR nature of her "employment." Let's see if I'm following Vinge's logic: When Victor vanishes by pulling down his zipper, does he really transfer to the real world? The Ellen twins suggest that such a return is impossible. I would guess that that Victor just prematurely aborts his virtual self in the current cycle. Only his text reports, if any, reach the outside world. Even if Reich has perfected a way to upload VR avatars into their originals' bodies (presumably overwriting their real-world memories), I doubt the busy professor would have the patience to listen to dozens (or hundreds) of Victor's smart remarks every day. No, Victor does not—at first—recognize the danger represented by the e-mail because—just like Dixie Mae—he gets freshly reloaded each cycle with no knowledge of what happens in earlier cycles.

I wonder if Vinge has a novel in the works. If so, Victor may prove more help than hindrance—if he ever catches

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wise.

Richard M. Boothe
Los Angeles, CA

The author replies . . .

Yes, at first Victor actually encourages Dixie Mae, in an effort to track down the origin of the mystery email. It looks suspicious to him and he is playing detective. Then when Ellen points out the date discrepancy, he suddenly realizes that the victims are very likely to figure important things out, and possibly blow this run entirely. From that instant on, his tactics are to slow and stop the investigation. Unfortunately for him, by the time he decides he should make a report, the Ellens and Dixie Mae are blocking him. In the end, by "leaking out," he probably has alerted Gerry that there is a problem, but little more.

I would like to write a novel around the "Cookie Monster." It is boggling—in an evil way—how many useful things Gerry's slavery could be used for (like effective spam filters).

* * *

Dear Stan,

This is just general carping about lunar astrophysics. Many of your authors apparently think that an Earth type planet could have two moons of significant size. (Not tiny ones like Mars!) Story after story has the soft silver glow of prima later modified by the gold of secundus or similar nonsense. The ultimate insult to lunar consideration came in the recent TV presentation of "Dune" wherein the final scene shows two large moons, one in quarter phase and the other in full! The star had a split personality!

Can't you inform your authors and readers that an Earth size planet, or any planet I suppose, can't have more than one satellite whose mass is greater than a certain proportion of the primary? Indeed, aside from the orbital instability, the presently dominant theory of lunar formation would seem to exclude the possibility of a second moon being able to form.

Albert J. Hoch Jr. ■

Today's science fiction is tomorrow's science fact—and vice versa.

—Kelvin Throop

Authority without wisdom is like a heavy ax without an edge, fitter to bruise than polish.

—Anne Bradstreet

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UPCOMING EVENTS Anthony Lewis

2–4 April 2004
COASTCON XXVII (Gulf Coast SF conference) at Gulf Beach Resort and Mississippi Coast Convention Center, Biloxi, MI. Registration: $35 until 1 March 2004, $40 at the door. Info: CoastCon 27, Box 1423, Biloxi, MS 39533; coast_inc@yahoo.com or chairman@coastcon.org; www.coastcon.org.

2–4 April 2004
ODYSSEY CON IV (Wisconsin area SF and gaming conference) at Radisson Inn, Madison, WI. Guests of Honor: Joe Haldeman, David Weber. Registration: $40. Info: Jerome Van Epps, 901 Jenifer St., Madison WI 53703; (608) 260-9924; oddcon@oddcon.org; www.oddcon.org

8–11 April 2004
GAYLAXICON 2004: SAN DIEGO (SF conference for gay fans and their friends) at Red Lion Hanalei Hotel, San Diego, CA. Guests of Honor: David Gerrold, Joe Phillips. Registration: $50 until 29 February 2004, $60 at door. Info: Gaylaxicon 2004, 1010 University Ave, PMB #946, San Diego, CA 92103-3395; Gaylaxicon2004@aol.com; www.gaylaxicon.org/2004/index.htm

8–11 April 2004
WORLD HORROR CONVENTION 2004 at Embassy Suites Phoenix North, Phoenix, AZ. TM: David Morrell. Artist Guest of Honor: Caniglia. Editor Guest of Honor: Stephen Jones. Writer's Workshop Guest of Honor: Mort Castle. Registration: $120 until 31 March 2004, $130 at door. Info: World Horror 2004, c/o LepreCon, Inc., Box 26665, Tempe, AZ 85285; (480)945-6890; fax: (480)941-3438; whc2004@ leprecon.org or mwillmoth@compuserve.com; www.leprecon.org/whc2004.

15–18 April 2004
NEBULA AWARDS WEEKEND 2004 (Annual SFWA Awards) at Westin Hotel, Seattle, WA. Info: Astrid Anderson Bear; astrbear@ix.netcom.com; www.sfwa.org/awards/2004/index.html.

2–6 September 2004
NOREASCON 4 (62nd World Science Fiction Convention) at Sheraton Boston, Marriott, and Hynes Convention Center, Boston, MA. Guests of Honor: William Tenn, Terry Pratchett, Jack Speer, Peter Weston. Registration until 30 September 2003: Attending USD180, Supporting USD35, Child USD105. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Info: Noreascon 4, Post Office Box 1010, Framingham, MA 01701. FAX: (617)776-3243. info@noreascon.org; www.noreascon4.org.

Running a convention? If your convention has a telephone number, fax number, email address, or web page URL, please let us know so that we can publish this information. We must have your information in hand SIX months before the date of your convention.■

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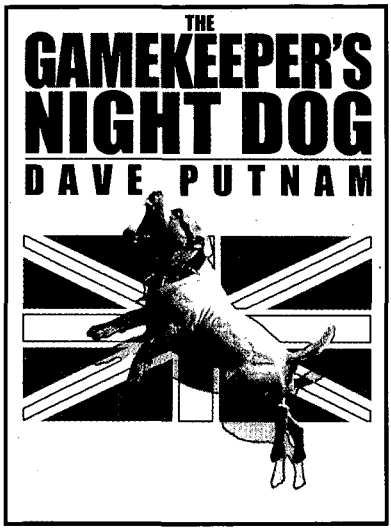
What if The Sun Had Never Set on Britain's Empire?



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